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ABSTRACT

Although consumers are sensitive to purchasing products that are recyclable and biodegradable, which products are truly environmentally sound is not clear. This teacher guide contains activities to help educate students in grades 3-6 about choices they and their families make that may affect their future health and welfare. The lessons may be taught as a comprehensive unit or individually integrated into existing classroom programs. The book is divided into two sections. Lessons and activities in the first section are interdisciplinary and action-oriented. Topics treated in this section include the history of waste, the roots of the current waste problem in societies changing lifestyle, how waste affects the earth's natural resources, and the different methods of waste disposal. The lessons in the second section offer concrete solutions and strategies to reduce waste by composting, recycling, and reusing natural resources. Each lesson in the two sections contains the subjects into which the lesson can be integrated, time needed for the lesson, the lesson's focus, learning objectives, background information, materials needed, procedures to carry out the lesson, and ideas for extended learning. Reproducible student worksheets accompany the lessons. Appended information includes a glossary of 37 terms; a list of activity sources; a list of 13 recommended resources and 6 children's video recordings; and a description of a school recycling project. (MDH)

ED 367 550

What a Waste!

A Teacher's Resource for Integrating the Solid Waste Crisis into the Classroom©

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What a Waste!

A Teacher's Resource for Integrating the Solid Waste Crisis into the Classroom©

by
The Southwest Connecticut Regional
Recycling Operating Committee (SWEROC)

Millie M. Horosko, Editor

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Acknowledgments

I wish to thank the following people for their assistance in the development of *"What A Waste!"*

It was the enthusiastic response of Southwest Connecticut teachers, who participated in the solid waste workshops conducted by SWEROC, that inspired the creation of *"What A Waste!"*

It was the dedication, commitment and help of Myrna Silverman and Kimberly Moore, major figures in the development, designing, editing and proofing of *"What A Waste!"* who were instrumental in bringing this manual to completion.

I am also grateful for Valerie Knight's invaluable support and advice and Jean Lane's and John McKee's pratical know-how and hard work that helped to make this manual possible.

And last but not least, I am grateful to the Southwest Connecticut Regional Recycling Operating Committee who made the publication of *"What A Waste!"* a reality.

Millie M. Horosko
Editor, *"What A Waste!"*

The Southwest Connecticut Regional Recycling Operating Committee
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Introduction

"...it wasn't the Sierra Club or the Izaak Walton League or the Environmental Defense Fund who forced McDonald's to very publicly change a marketing strategy by eliminating foam sandwich packaging. It was elementary school children."

James E. Lukaszewski, "It Ain't Easy Being Green." Speech delivered before the Union League Club, Philadelphia, PA, February 18, 1991 as reported in "Vital Speeches of the Day," LVII, no. 17, June 15, 1991, p. 532.

Consumers are participating more than ever in actions that set policy and affect changes in the manufacturing, packaging, marketing and ultimate disposal of goods. Americans are even willing to pay more for products that are environmentally sensitive. Recycling bins and bundled newspapers are becoming a common sight in communities throughout the United States. "Recyclable" and "biodegradable" have become hot buzz words for activists and advertisers alike.

The choices are not always clear-cut, however, and are often confounding. Which products are truly environmentally sound? Can companies be relied on to supply accurate information about their products? Are activist groups to be trusted when their charges are refuted by reputable scientists? Are containers really recyclable when no markets exist to purchase and reuse the waste products? Are paper bags better than plastic bags, or cloth diapers superior to disposable ones, when viewed from a long-term perspective?*

The public needs information to sort out claim and counterclaim and make wise choices — choices communities will have to live with for centuries. Choices that will affect the health and welfare of our families and the world.

What A Waste! was created to help teachers educate students in elementary schools, grades 3 through 6, but can be modified to use in other grades, too. The goal is to have students carry to their families and communities the vital message that each individual can play a significant role in saving the earth. The lessons and activities in this packet have been presented to teachers in workshops conducted in Southwest Connecticut. The teachers, in turn, are integrating the activities and principles learned into their curricula.

The lessons in this manual may be taught as a comprehensive unit, as presented here, or may be individually integrated into existing classroom programs. Related subjects, as well as the major focus, are set forth at the beginning of each lesson. The time required to present the activities is intended to be used only as a guideline. Teachers should adapt the materials to the ability levels and interests of their students. Some lessons may be presented in just 30 minutes. Others may be extended over the course of an entire unit or period of months.

* National Wildlife Federation, Conservation Exchange, vol. 9, no. 2, (Washington, DC: Winter 1991).

Where classes are challenged and excited, teachers may elect to offer a more in-depth approach to the subject matter. Activities for this purpose are grouped under the heading **Extended Learning**. Fact sheets, student worksheets, and teacher references accompany many of the lessons. Teachers may wish to use these as presented or to extract useful segments.

"What a Waste!" is divided into two sections. Lessons and activities in the first section are interdisciplinary and action-oriented; they introduce the problems inherent in our solid waste crisis. The lessons in section two offer concrete solutions and strategies to reduce waste by composting, recycling and reusing our resources. Students who complete these exercises will realize that they must be concerned and can indeed make a difference — they all can be part of the solution to our solid waste crisis.

Solid and hazardous waste problems exist in every community. Society as a whole, and each of us as individuals, contribute to the problem. In America, the situation is particularly critical. We produce almost three times more solid waste than many other countries. In Connecticut alone, each of us generates a ton of garbage every year; collectively that amounts to 3.3 million tons annually.

There is no single solution to our solid waste problem. The choices each of us makes, and the actions we take every day, make the critical difference in dealing effectively with this crisis.

The American Indians were our first environmentalists. It is hoped that these lessons will help students recapture some of our native Americans' respect for nature and the environment and to embrace a new and more caring attitude toward our surroundings and our resources. It is vital that they do so, if we are to survive on this beautiful planet.

A Word About SWEROC

The Southwest Connecticut Regional Recycling Operating Committee (SWEROC) is a consortium of 19 towns in Connecticut chosen as the state's demonstration recycling district. The organization was created to develop, implement and promote a regional approach to recycling in compliance with mandatory recycling in Connecticut. The state's recycling law, which took effect on January 1, 1991, established a statewide recycling goal of 25 percent of the solid waste generated.

The municipalities participating in SWEROC are: Bridgeport, Darien, East Haven, Easton, Fairfield, Greenwich, Milford, Monroe, New Canaan, Norwalk, Orange, Shelton, Stamford, Stratford, Trumbull, Weston, Westport, Wilton, and Woodbridge.

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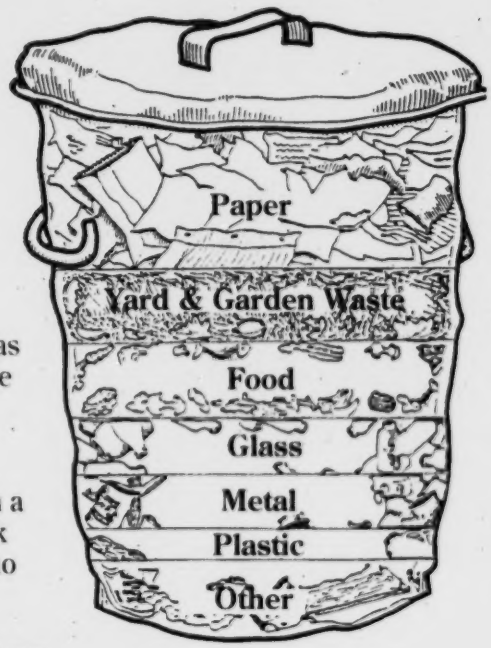
Section I
The Problem: Our Solid Waste Crisis

I. Waste – What Is It?

- History of Trash
- Garbage Bag Recipe
- A Look Inside America's Garbage Pail
- Name That Trash



Overview:

Waste has always been a problem, but the magnitude of the problem has greatly increased over the years. The reasons for this are directly related to our "throw-away" lifestyle.

The lessons in this chapter establish a basis for students to begin to rethink their definition of garbage. We can no longer afford to view garbage as a collection of worthless objects. Its contents are valuable resources that can be recovered and turned into useful products.

In Garbage Bag Recipe, students take a critical look at the contents of their school trash cans and brainstorm ways these objects can be "rescued." Attitudes toward garbage, now and through the ages, are explored in *A Look Inside America's Garbage Pail*. Students learn to identify the resources utilized to make the objects we throw away, and the difference between renewable and nonrenewable resources, in *Name That Trash*.

These lessons are the building blocks for the next three lessons in Section I, which provide a deeper understanding of our solid waste crisis.

History of Trash

■ **Pre-History**
Many years ago, prehistoric peoples simply threw their trash on the ground. Since the trash consisted primarily of biodegradable items like vegetable matter, it generally decomposed. Even non-biodegradable objects, such as old bone tools, never accumulated to any significant extent because people lived in small groups and moved from place to place.

■ **Ancient Greece and Rome, 300 B.C.**
Residents in ancient Greek and Roman cities threw their trash into the streets. Human scavengers regularly picked through the waste for reusable items, a practice that continues even today in parts of the world. Road levels grew higher and higher from the accumulation of trash. Old, torn-down homes were used as foundations to make newly built homes level with the roads. People in Greece finally organized a system of municipal trash collection. Waste was carried to dumps at least a mile outside of town.

■ **Medieval Europe, AD 1350**
People in the Middle Ages also threw trash, food and human waste out into the streets. This practice caused a problem in densely populated cities, such as London, where the mess contributed to the spread of various diseases. (The bubonic plague was one disease that became epidemic. It was started by fleas from infested rats which swarmed through crowded cities.)

■ **The Age of Exploration, AD 1500**
People throughout history have considered the ocean limitless and have thrown trash into it without hesitation. The trash and food waste dumped during the age of the great explorers usually disintegrated in the salt water. Today, however, plastic disposables, hazardous waste and other materials are harming marine life and washing up onto beaches, posing a danger to people and coastal wildlife. It is estimated that people around the world dump nearly 14 billion pounds of waste into the oceans each year.

■ **The Industrial Revolution, 1860**
During the Industrial Revolution, large manufacturing cities in the U.S. became filthier than cities in previous periods. Dead horses, coal and wood ash from furnaces, and kitchen and animal waste filled streets and alleys. Pigs roamed the streets, eating much of the food waste. Rats and roaches invaded the rotting mess, and there were epidemics of disease. For a time, people believed that the foul fumes carried germs that could be transmitted to people. Although this theory was disproved around

1880, the concern about public health did lead to city street cleaning and better-regulated municipal garbage collection and disposal.

■ **United States, Early Twentieth Century**
Open dumps, with their affiliated problems of rodents, fires and odors, have existed since prehistoric times. They remained as a common method of disposal in the U.S. until after World War II, when landfills replaced them.

Large-scale burning of trash in incineration plants has been used as a waste-disposal method since the 1960's. Although incinerators significantly reduced the volume of trash, citizens complained about the smoke, odors and airborne residue from these plants.

■ **United States, The Post-War Years**
The period following World War II marked the rise of the use of synthetic materials and the "throw-away" lifestyle. Households no longer burned much wood or coal, but they generated more waste from disposable products and packaging materials, including a lot of paper and plastic trash. More toxic substances ended up in dumps and landfills, where they leached through the soil into ground water. Sometimes dumps caught fire and smoldered, releasing toxic fumes. It later became clear that, as landfills filled up, siting new, "safe" ones would become more and more difficult.

In the 1970's, a movement to control the increasing volume of garbage going into landfills led to a revival of interest in incineration. New technology focused on converting waste to energy in "resource recovery" plants that reduced the volume of trash and produced usable energy. This was seen as an added benefit, particularly after an oil shortage raised concerns about the nation's limited energy sources. But the plants were expensive to build and run, and no one wanted them built in their backyard. Because of these problems, resource recovery plants have yet to gain widespread acceptance.

In the 1990's due to technological advances, resource recovery plants are much more efficient than they were twenty years ago. Facilities now use scrubbers to prevent fly ash from escaping into the atmosphere. In addition, citizens in the U.S. and throughout the world have begun to reduce, reuse and recycle to cut the total amount of materials entering the solid waste stream and to preserve natural resources.

Garbage Bag Recipe

Subjects: Language Arts, Science, Social Studies

Time: 30 Minutes

Focus: Waste Reduction, Source Separation, Natural Resources

Concept: Solid waste is everything we find useless and throw away.

Learning Objective: Students will define solid waste, identify major components of the waste stream and begin to question their "throw-away" habits.

Background: Studies show that almost 60% of what we throw away still has value and could be reused, recycled or composted. Diverting these resources from the waste stream begins with recognizing the resource potential of what we discard each day. This activity sets the stage for future lessons and activities by creating a classroom display that can be used over and over.

Materials:
Waste basket
Typical items from the trash can in school and at home
"Garbage Bag Ingredients" worksheet on page 6.

Procedures:

- Begin by examining the objects in the classroom trash can. Discuss the different kinds of trash. What kinds of trash would be found in the cafeteria? The library? In other rooms at school?

- Next gather objects from home. Ask each child to bring to class one or two items from the list on page 6. This can be an actual object or a drawing of the item pasted on cardboard.

- When all the components have been assembled, put them in a large garbage bag. The garbage bag can be used for different exercises; for example, the contents can be sorted and classified by packaging types, resource bases, biodegradable or non-biodegradable, made from renewable or non-renewable resources, recyclable or reusable, etc. What can the items be recycled into? How could they be reused?

Extended Learning:

1. Who Wants to Go to the Dump? Hand one trash object to each student and have all the students stand together in a group representing one large trash bag. The teacher can be the trash collector who will take the trash away. Describe what happens at a sanitary landfill and ask the students if anyone really wants to go to the dump. Explain that they can be "rescued" by thinking of ways they can be reused or recycled. Try to save all the items in the trash bag by thinking of alternative uses for each. Discuss ways to redesign products that cannot be recycled or reused. Continue until all the students have been rescued.

2. Use magazines cutouts for a collage. Also bring in real components of trash.

3. Find magazine pictures of things that get thrown out after one use and things that are used for a long time. Make posters or a display contrasting the two types. Compare each throw-away object to the same object 50 or 100 years ago (razors, paper napkins, paper grocery bags, ballpoint pens, etc.).

Garbage Bag Ingredients

This list represents the contents of a typical five-pound residential trash bag.

Paper plate
Glass jar
Old rag
Junk mail
Plastic produce bag
Styrofoam cup
Newspaper
Plastic detergent bottle
Apple core
Dead branches and leaves
Cardboard cereal box
Brick-pack juice container
Plastic-coated milk carton
Styrofoam or cardboard egg carton
Fast-food restaurant packaging
Brown paper bag
Aluminum can
Disposable diaper
Corrugated packing box
Six-pack plastic ring
Plastic film
Plastic magarine tub
Banana peel
Chicken bones
Plastic cider jug
Coffee grounds

Adapted with permission from Association of Vermont Recyclers' *Teacher's Resource Guide for Solid Waste and Recycling Education*, AVR, PO Box 1244, Montpelier, VT 05601

A Look Inside America's Garbage Pail

Subjects: Math, Social Studies

Time: One Class Period

Focus: Recycling, Solid Waste

Concept: To deal with our solid waste crisis we must begin to regard our recyclable garbage as a resource rather than as worthless trash.

Learning Objective: Students will examine the contents of a garbage pail to understand the valuable resources represented now that we are recycling, and to begin to question our "throw-away" habits.

Background: Prior to recycling, we had a negative regard for things in our garbage pail.

Materials: Garbage pail graphics (Student's Worksheet and Teacher's Reference) and "History of Trash" fact sheet.

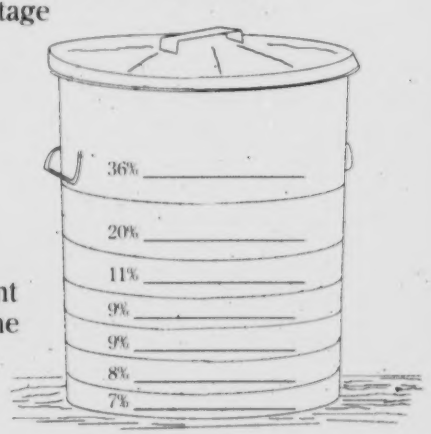
Procedures:

1. Ask students to discuss what the word "garbage" means to them. Write these definitions on the chalkboard for later use in comparing/contrasting how attitudes have changed. Using the fact sheet "History of Trash," trace how our attitudes toward garbage have changed.

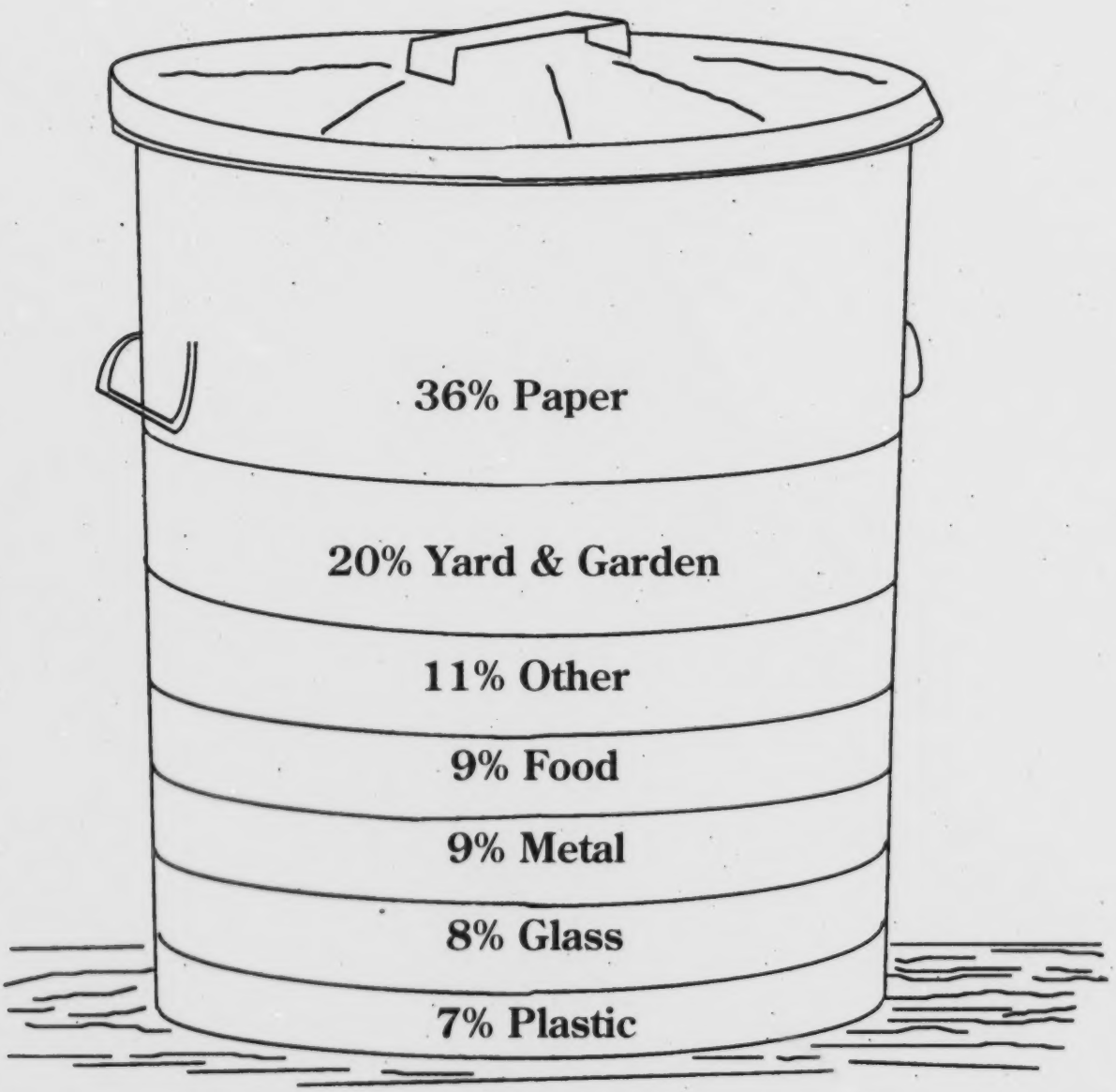
2. How much do various items contribute to the volume of our garbage? Have the students match the items normally found in garbage, listed on the worksheet, with the percentage estimates on the garbage pail.

3. Discuss how many garbage pail items now can be recycled or composted.

4. Review the descriptions of the word "garbage" written earlier on the chalkboard and compare our attitudes about garbage before and after the advent of recycling. Ask students to describe the attitudes we should have now that we realize our garbage is a valuable resource. Erase the negative words from the chalkboard and replace them with the new, positive ones.



What's in America's Garbage Pail?
(U.S. Waste Stream Percentages)



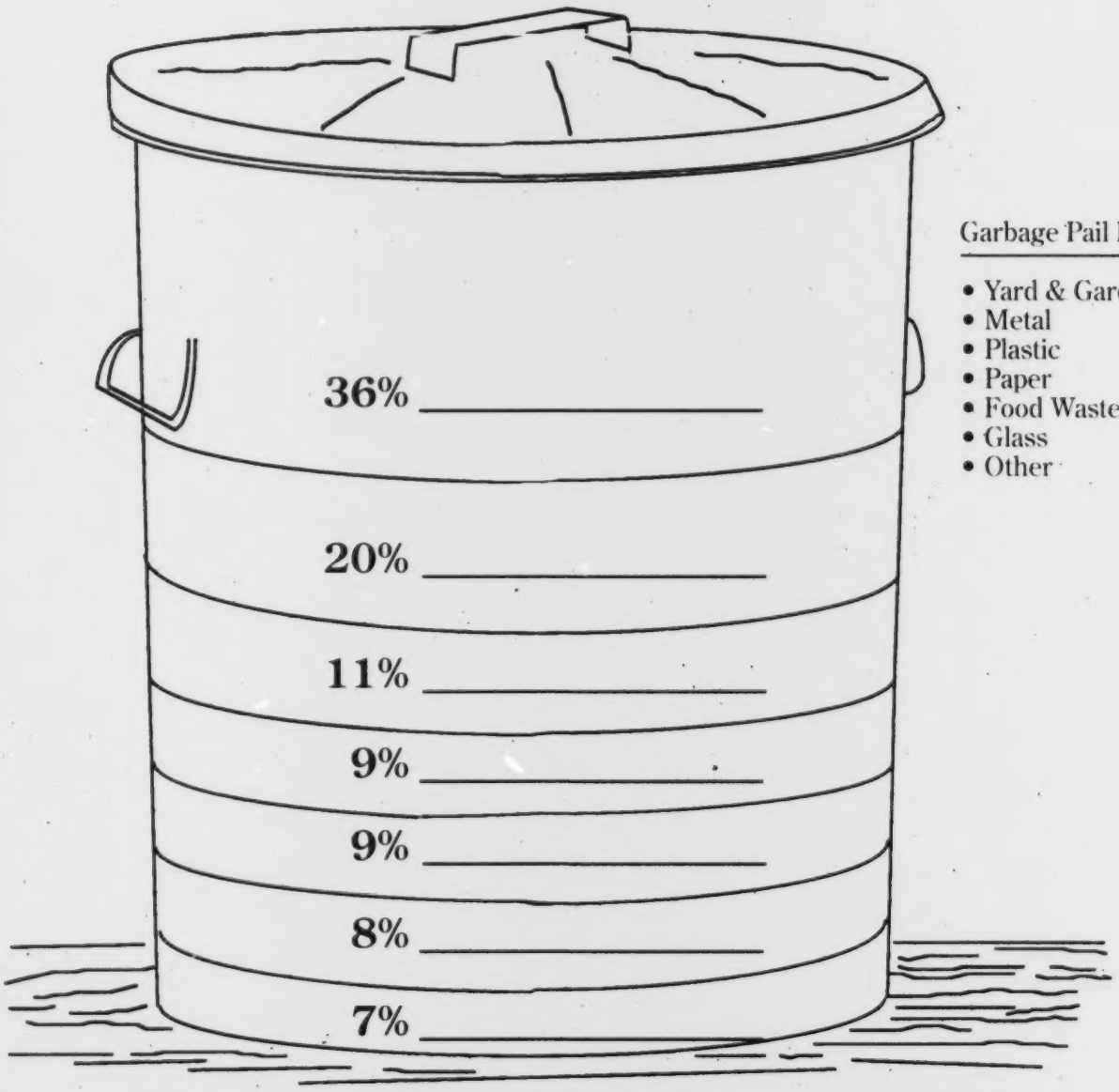
What's in America's Garbage Pail?

(U.S. Waste Stream Percentages)

Adapted with permission from: *A-way With Waste*, Department of Ecology 4350 150th Avenue N.E. Redmond, WA 98052

Sources: *Characterization of Municipal Solid Waste in the United States, 1960 to 2000* (update 1988) Franklin Associates LTD., (Rounded to the nearest percent)

Name: _____



Garbage Pail Items:

- Yard & Garden Waste
- Metal
- Plastic
- Paper
- Food Waste
- Glass
- Other

What's in America's Garbage Pail?

(U.S. Waste Stream Percentages)

Adapted with permission from: *A-way With Waste*, Department of Ecology 4350 150th Avenue N.E. Redmond, WA 98052

Sources: *Characterization of Municipal Solid Waste in the United States, 1960 to 2000* (update 1988) Franklin Associates LTD., (Rounded to the nearest percent)

Name That Trash

Subjects: Science, Environmental Education, Social Studies

Time: One Class Period

Focus: Solid Waste, Renewable and Non-renewable Resources

Concept: Major problems are caused by the excessive amount of waste we generate.

Learning Objective: To understand the distinction between renewable and non-renewable resources and the trash derived from each of these.

Background: We don't usually give much thought to the natural resources used to make the ordinary things we throw away every day. This lesson will help us to become more aware of their origin and value.

Materials: Stack of 3 x 5 cards and tape or Post-it™ notes. Each note should bear the name of a different type of trash written in large letters: paper plate, cotton T-shirt, cardboard, plastic cookie package, notebook paper, orange peel, plastic wrap, banana peel, plastic grocery bag, paper towel, aluminum can, plastic silverware, glass jar, paper napkin, apple core, disposable pen, newspaper, soup can, plastic soda bottle, milk carton, toothpaste tube, aluminum foil, steak bone, potato skins, old wool sock, etc.

"Name That Trash" worksheet

Procedures:

1. Hang a trash item card or Post-it™ note on the back of each child without the child seeing it.
2. Next, distribute the "Name That Trash" worksheet to help start the questioning.
3. Assemble the students in groups and have them take turns asking each other "yes" or "no" questions about items until each child guesses what he or she is.

Name: _____

Name That Trash

1. Am I made from a renewable resource (plant or animal)?

_____

2. Am I made from a non-renewable resource (minerals, fossil fuels or rocks)?

_____

3. Am I something to use at home? school? work? out-of-doors?

_____

4. Am I something to eat?

_____

5. Am I something to drink?

_____

6. Am I something to wear (casual or dressy)?

_____

7. Am I packaging?

_____

8. Am I a container?

_____

9. Can I be used again?

_____

Adapted with permission from: *Waste Away. Information and Activities for Investigating Trash Problems and Solutions*, Vermont Institute of Natural Science, PO Box 86, Woodstock, VT 05091.

Section I:
The Problem: Our Solid Waste Crisis

II. The Roots of Our Waste Problem

- Then and Now
- Changing Lifestyles
- Too Much Packaging

Overview:

Our lifestyle is responsible for our solid waste crisis. We consume too much. We throw away too many things. We don't conserve and reuse the products we buy.

In this chapter, students contrast the number of products available and the ways in which they were used in great-grandma's day and our own. The difference is demonstrated dramatically in *Changing Lifestyles*, when students run a relay race depositing objects in boxes representing the two time periods. The number of objects in each box graphically illustrates the point.

Too Much Packaging introduces the fact that 20 - 40% of all household waste consists of packaging. By creating a collage of gum wrappers used in a single package of chewing gum, students begin to see how excess packaging on a small scale is amplified when each student consumes a pack of gum a day, and what the resultant garbage might be over the course of a year. Sensible versus excessive packaging is explored in activities like rethinking packaging choices when shopping, and brainstorming ways to reduce the amount of packaging in products students use everyday.

The Roots of Our Waste Problem

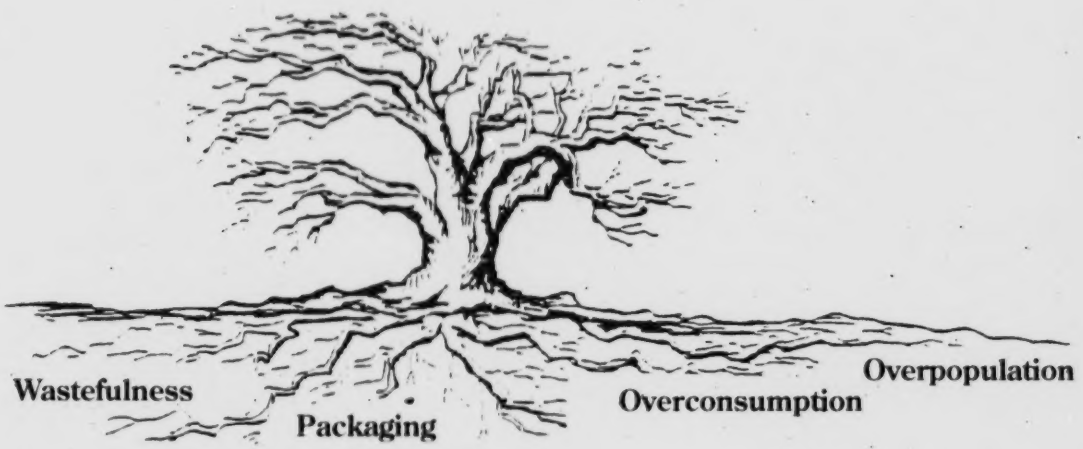


Illustration courtesy of: *Waste Away*, Vermont Institute of Natural Science, P.O. Box 86. Woodstock, VT 05091

Then and Now

Subjects: Social Studies, Home Economics, Language Arts

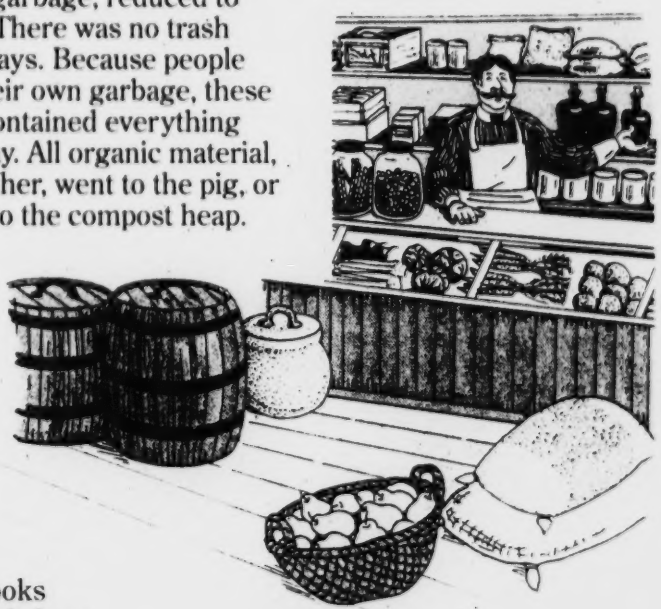
Time: One Class Period

Focus: Solid Waste

Concept: What we throw away has changed with technological advances, increased wealth and changes in lifestyle.

Learning Objective: Students will be able to describe ways in which changing household habits have intensified the human impact on the environment.

Background: Garbage dumps from the past usually contained such items as heel irons (those horseshoe-shaped metal strips farmers nailed to their boots), the occasional decayed boot itself, old enameled saucepans with holes in them, bits of pottery, nearly worn-out remnants of sickles or scythes, spade blades, and, in the upper part of the heap, some broken bottles. Decades of garbage, reduced to just one small pile. There was no trash collection in those days. Because people had to dispose of their own garbage, these household dumps contained everything that was thrown away. All organic material, however, except leather, went to the pig, or if there was no pig, to the compost heap. There was hardly any garbage of the kind we produce today. (Adapted from John Seymour and Herbert Girardet, 1987.)



Materials:
Pictures
Artifacts
Historic resource books
"Then and Now" worksheet

Procedures:

1. Ask the students to make a list of the items they use every day (kitchen appliances, bathroom conveniences, means of transportation, school materials, clothing, food, etc.).

2. Have each student pick one item from the list and research its equivalent of 100 or 200 years ago. Assemble information, including pictures of, or actual artifacts and their modern equivalents. Then have students complete the "Then and Now" worksheet.

3. In class, discuss differences between items from the two eras. How do these differences affect our solid waste crisis?

Extended Learning:

1. Invent an alternative to a modern convenience which would not use any non-renewable resources to operate, would last a long time, and would not adversely affect the environment when its useful life was over.

2. Interview older folks in the community to see what they have to say about life before modern conveniences.

Adapted with permission from Association of Vermont Recyclers' *Teacher's Resource Guide for Solid Waste and Recycling Education*, AVR, P.O. Box 1244, Montpelier, VT 05601.

Name: _____

Then and Now

Present-Day Item:

Antique Predecessor:

1. Consider the following characteristics of each object:
   a. Is it made from natural or synthetic components?

      Now: _____

      Then: _____

   b. Is it made from renewable or non-renewable resources?

      Now: _____

      Then: _____

   c. Is it labor saving or labor intensive?

      Now: _____

      Then: _____

   d. Does it require energy from renewable or non-renewable resources to operate?

      Now: _____

      Then: _____

   e. Does it last a long time or is it disposed of quickly?

      Now: _____

      Then: _____

   f. Is it hand-crafted or mass-produced?

      Now: _____

      Then: _____

g. Is it something you wouldn't want to have to do without or something you wouldn't mind giving up?

Now: _____

Then: _____

h. Is it non-biodegradable or biodegradable?

Now: _____

Then: _____

i. Is it non-toxic or does it contain hazardous substances?

Now: _____

Then: _____

j. Is it necessary for survival or a convenience?

Now: _____

Then: _____

2. List some "luxuries" from the past that are considered necessities today.

_____

_____

3. What changes in lifestyle would result from the following:
   a. Loss of a non-renewable resource

_____

   b. Drastic increase in the price of non-renewable fuel

_____

   c. Irreparable damage to a renewable resource (e.g. ground water contamination, depletion of forest, animal extinction)

_____

Changing Lifestyles

Subjects: Science, Social Studies, History, Environmental Studies

Time: One Class Period

Focus: Solid Waste

Concept: Our lifestyle contributes to our solid waste crisis.

Learning Objective: To promote awareness of the relationship between lifestyle and the generation of waste.

Background: In great-grandma's day, people had a lot fewer possessions. Purchases were not packaged but carried home in hand or in a basket.

Materials:

Two boxes
Two bags
Miscellaneous *unbreakable* items such as:
- Hand-knit cap
- Styrofoam cup
- Canning jar
- Wooden spoon
- Plastic bowl
- Other assorted items found in the trash

(Note: In your item selection, gather a larger assortment of modern items, to illustrate that people now have more possessions than they did in the past.)

Procedures:

1. Designate a large open area and divide the class into two teams. Have each team form a line.

2. Place two large boxes labeled "Great-Grandma's House" and "My House" at the far side of the room.

3. In front of each line of students, place a bag of miscellaneous household items representative of both modern (throwaway) and circa 1900 (durable) lifestyles.

4. At a signal, students run a relay race with each team member choosing an object from the bag and depositing it in the box where the object would most likely be found (Great-Grandma's House or My House).

5. After the race, have the class discuss how lifestyles affect waste generation:

   a. Which box has more items in it? Why?

   b. How many items in each box are reusable?

   c. How many items in each box are recyclable?

   d. Which items are made from renewable resources?

   e. Which items are made from non-renewable resources?

   f. What are some good substitutes for items used only once?

Adapted with permission from *Waste Away*, Vermont Institute of Natural Science, P.O. Box 86, Woodstock, VT 05091

Too Much Packaging

Subjects: Math, Art, Social Studies

Time: One Class Period

Focus: Excessive Packaging

Concept: Packaging is a major component of the waste stream.

Learning Objective: Students will learn to identify excessive packaging and understand how it impacts our environment.

Background: Packaging comprises 20 - 40% of all household waste. Packaging is necessary to protect food from contaminants, but composite and duplicate layers of non-recyclable packaging add unnecessarily to the waste stream. For example, paper packaging, when coated with plastic or aluminum, can't be recycled.

When we throw out one candy wrapper at a time, we rarely are aware of how much waste we produce, but little pieces add up quickly to a surprisingly large amount. We can each help reduce the volume of solid waste plaguing our society by choosing products with less packaging or packaged in materials that can be recycled.

Materials: Packages of sugarless gum (one piece per student)
Construction paper
Glue

Procedures:

1. Divide students into groups. The number of students per group should equal the number of pieces of gum in each package. Pass out one package of sugarless gum to each group and ask the students to unwrap the gum carefully, without tearing the wrappers.

2. Have each group create a poster by gluing all the wrappers and the packaging onto a piece of construction paper. Place the wrappers so they can be easily counted.

3. When the posters are finished, ask the children to guess how many wrappers there are, and then to count them. Ask the class: If you chewed one pack of gum every week, how many separate wrappers would you be adding to the waste stream each week? Each year?

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4. Discuss the reasons why there are so many wrappers. Identify the possible purposes of each layer. Ask the students how they would package the gum. What are the reasons for their choices?

5. Ask the children to identify the source of raw materials for packaging: plastic, aluminum foil, paper. Discuss depletion of natural resources and possible ways to conserve these resources – recycling, precycling (avoiding excessively packaged goods), and reusing.

6. Ask the children to think of other things that their families buy that come in packages. Which of these have the greatest number of packaging layers or pieces? (Consider individually wrapped sliced cheese, candy, crackers, single-serving instant foods and beverages.) If we reduce the amount of packaging, will we reduce the amount of trash? Brainstorm ways to reduce packaging.

Extended Learning:

1. Have students think of one food they enjoy eating that uses a lot of packaging and one food that uses very little packaging. Can they choose to eat the item that uses less? Does the same product come in different types of packaging so they can choose the least amount of packaging and still have their favorite food?

2. How long do gum wrappers take to decompose? Bury some in the ground. Check them after one week, one month and six months.

3. Compare and make displays of "nature's packaging" and "people's packaging." Why is nature's packaging useful to the earth?

4. Visit a food co-op and grocery store and compare packaging found at each.

5. Look for food products packaged in recycled materials. Write letters to companies thanking them for using recycled material or asking them to use recycled paper.

Adapted with permission from Association of Vermont Recyclers' *Teacher's Resource Guide for Solid Waste and Recycling Education*, AVR, P.O. Box 1244, Montpelier, VT 05601.

Section I
The Problem: Our Solid Waste Crisis

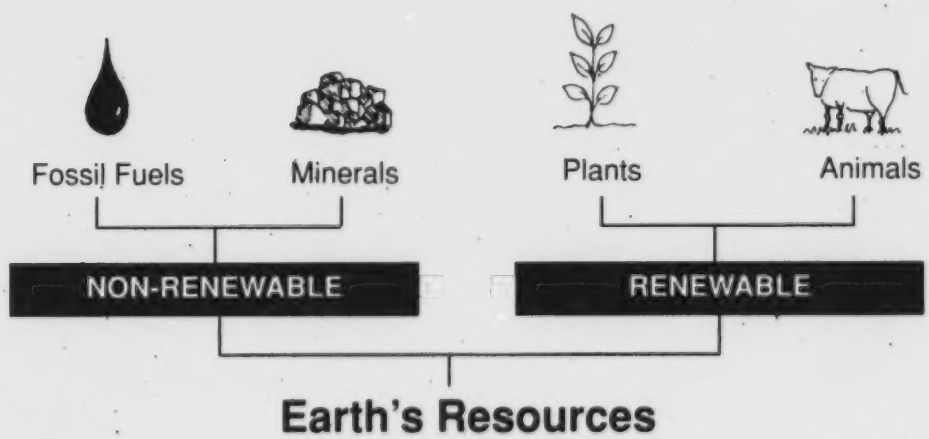
III. How Waste Affects Our Natural Resources

- Everything Comes From the Earth
- After Dinner, More Than Leftovers!
- Will We Ever Run Out?

Overview:

In this chapter students learn that every product they use and throw away derives from and has an impact on the earth. The concept of life-cycle analysis of a product is introduced: Does a product derive from a renewable or non-renewable resource? How much energy is consumed in manufacturing and transporting the product? How is the product disposed of? Finally, students learn to evaluate packaging in the same manner as its contents. What resources are used to make the packaging materials? Can these resources be replaced or are they lost forever? *After Dinner, More than Leftovers!* presents students with the contents of an average dinner and asks them to list every container they must open to prepare the meal. The natural resources consumed in making the packages are enumerated, analyzed and traced to their source in the earth.

Students should come away from these lessons with an appreciation of the fact that what is removed from the earth may be gone forever. Choices to conserve and recycle can make a vital difference in the natural resources that remain for future generations.



Everything Comes From the Earth

Subjects: Science, Social Studies, Geography, Environmental Education, Art

Time: One Class Period

Focus: Natural Resources

Concept: The earth is the ultimate source of everything we make, use and throw away.

Learning Objective: To help students learn to conserve our natural resources by recognizing the raw materials consumed in making products that we throw away.

Background: Industry and technology have enabled people to accomplish many noble tasks, but they have also contributed to today's solid waste crisis. Before modern technology, the chore of harvesting the earth's natural resources, like minerals or petroleum, was extremely difficult. Today, with complex machinery, resources are removed easily, fostering the misconception that it is simple to find and harvest more of them. There is little incentive to conserve.

Materials:

- Egg
- Metal fork
- Reference books about natural resources
- Fact sheets: "Where Does it Come From?" and "Renewable and Non-Renewable Resources"
- "Everything Comes From the Earth" (Teacher's Reference and Student's Worksheet.)

Procedures:

1. Distribute "Everything Comes From the Earth" worksheet to students.

2. Divide the class into small groups and assign one item from the list on the worksheet to each group. Instruct groups to investigate their item until they have discovered in what form the item is derived from the earth and the steps involved in its manufacture.

3. Groups should prepare reports on their findings, including posters or dioramas, to illustrate the steps from raw material to finished product. Following these reports, the teacher should distribute the summary fact sheet "Where Does It Come From?"

4. Display an egg to the students and ask them to think about the natural resources used to create it. Help students recognize that an egg comes from a chicken, the chicken eats grain, and grain grows in soil that is nourished by sunlight and water.

5. Display a fork and explain to the students that everything comes from the earth, though we may not recognize it by looking at manufactured objects. For example, in producing steel to make the fork, a large amount of rock containing a small amount of iron must be mined. Energy-consuming machinery separates the iron from the rock. Then the iron ore is purified with oxygen to make steel. The finished steel must be transported from the point of manufacture to the point of use.

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

Where Does It Come From?

■ **Aluminum Can:**
Aluminum is made from bauxite, which is a non-renewable resource. Bauxite ore is mined in Australia and Brazil and shipped at great expense to its prime consumers, the United States and Russia. In the U.S., aluminum is extracted from the bauxite. Thousands of kilowatt hours of electricity are expended in extraction, and the process creates a significant amount of waste. For each ton of aluminum, four to five tons of waste rock are left over. A factory produces sheet aluminum and then ships this to another factory where beverage cans are cut from the sheets.

■ **Plastic Bag:**
Most plastics are made from petroleum, a non-renewable resource. Early plastics were made from cellulose, a plant fiber, which is still the basis for film, audiotape and videotape. Plexiglass is produced from petroleum, coal, air and water. Plastic bags and phonograph records are derived from a mixture of petroleum and chlorine.

■ **Leather Shoes:**
Real leather is made from the skin of animals. Many items that appear to be made of leather are actually made from vinyl, a kind of plastic. Animals represent a renewable resource. Plastics are made from non-renewable resources.

■ **Wooden Chair:**
The chair is manufactured from trees that grow in the earth. Trees are a renewable resource.

■ **Cotton Jeans:**
Bolls of cotton grow on plants throughout the southern United States. The cotton must be picked, cleaned, carded, made into yarn or thread, woven into cloth, dyed a color, cut and sewn into jeans, distributed to stores and sold. Cotton itself is a renewable resource, but a great deal of energy is expended to convert it into a pair of jeans.

■ **Newspaper:**
Paper is made from wood, a renewable resource. The basic ingredient of paper is wood pulp, soft wood broken down either by chemical processes or by grinding until the cellulose fibers separate. Chemically produced pulp is made into good quality writing paper; ground wood pulp is used for newsprint. The pulp is washed and screened, then mixed with water in a beater. During the beating process, colored dyes or chemical sizing may be added. The mixture is then screened and shaken to remove the water, pressed and dried over a series of hot cylinders, and wound into a roll of paper.

■ **Scissors:**
Steel is made from iron ore, a non-renewable resource. Iron ore is mined and then transported to a steel manufacturing plant. The ore is broken into small pieces and melted into a fuel called coke. Iron separates from other materials in the ore. Then limestone is added to the waste ore. At temperatures above 2800 degrees, the limestone/ waste ore mixture floats to the surface while the melted iron sinks to the bottom of the furnace. This melted iron, called pig iron, is purified in an oxygen furnace which converts it into steel. Melted steel is then poured off and shaped.

■ **Glass Bottle:**
Glass is made by melting silica, a fine white sand, in combination with soda (sodium carbonate) or small pieces of old broken glass called cullet, to help melt the silica faster. Lime (calcium carbonate) is sometimes added, too. The silica melts in a furnace at temperatures above 2600 degrees F. Silica is a non-renewable resource.

■ **Hamburger:**
Hamburger is made from beef which is the flesh of the cow. The bun is made from flour which comes from grain that grows in the ground. Grain also provides food for the cow. Both the cow and grain are renewable resources.

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

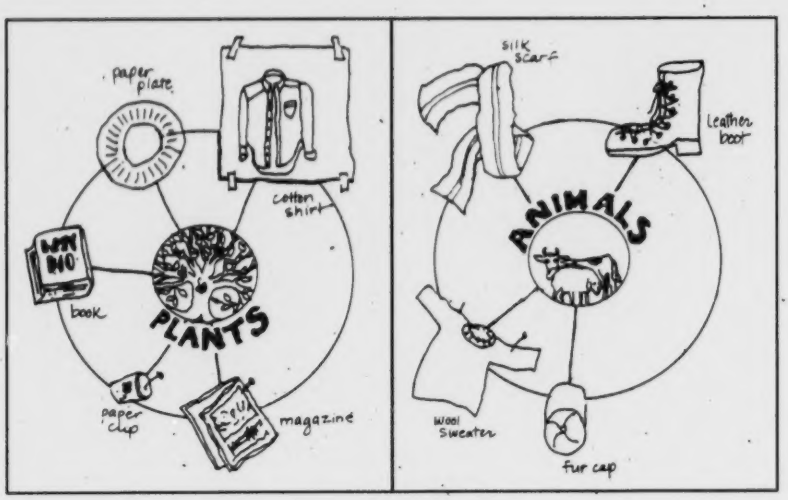
Everything Comes From the Earth

Renewable Resources:

Raw materials that can be replaced by nature in a relatively short period of time.

- **Plants**
  - books/newspapers/magazines
  - paper napkins
  - junk mail
  - paper towels
  - wooden chair
  - cotton shirt
  - straw broom
  - paper cups and plates

- **Animals**
  - shoes, boots
  - sheepskin mittens
  - leather belt
  - wool sweater
  - beef steak
  - milk
  - silk scarf
  - fur caps



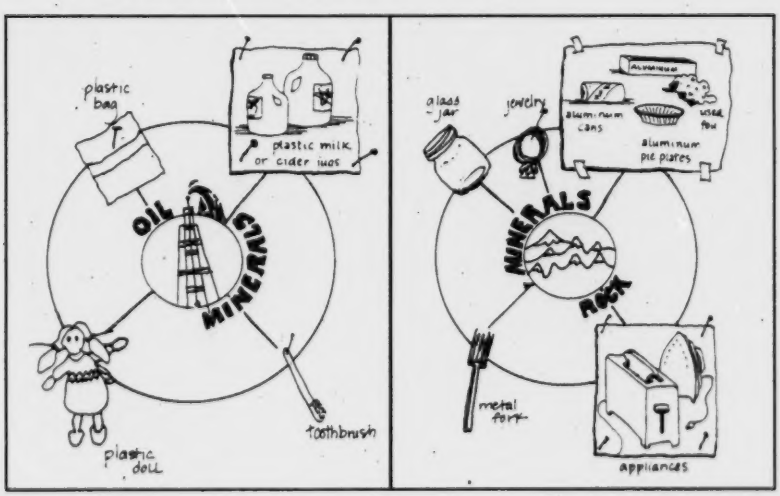
Everything Comes From the Earth

Non-renewable Resources:

Raw materials that cannot be replaced by nature in a relatively short period of time.

- **Oil/Minerals**
  - plastic trash can
  - plastic doll
  - acrylic clothing
  - plastic fork
  - motor oil
  - toothbrush
  - razor and pens (disposable)
  - shower curtain
  - plastic milk jug
  - plastic detergent container
  - plastic bag

- **Rock/Minerals**
  - steel
  - silver fork
  - metal bowl
  - soup can
  - aluminum windows
  - glass jar
  - ceramic plate
  - aluminum can, pie plates
  - appliances
  - jewelry: diamonds, gold, silver, copper



Teacher's Reference:

Everything Comes From the Earth

Identify the steps along the way which have changed the items listed. Try to trace each item back to its original source, the earth. For example, the egg you had for breakfast was once inside a chicken, which ate corn and other grains, which grew in the earth, so:

EGG - CHICKEN- GRAINS - EARTH

- Aluminum can:
  can-sheet aluminum-aluminum-bauxite-earth
- Plastic bag:
  plastic-petroleum-earth
- Leather shoes:
  shoes-leather-cow/pig, etc.-grains-earth
- Wooden chair:
  chair-lumber-tree-earth
- Cotton jeans:
  jeans-thread-cotton plant-earth
- Newspaper:
  paper-wood-tree-earth
- Steel scissors:
  scissors-steel-iron ore-earth
- Glass bottle:
  glass-silica/sand-earth
- Hamburger:
  bun-grains-earth meat-cow-grains earth
- Can you name one thing that does not come from the earth?
  no

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

Name: _____

Everything Comes From The Earth

Identify the steps along the way which have changed the items listed. Try to trace each item back to its orginal source, the earth. For example, the egg you had for breakfast was once inside a chicken, which ate corn and other grains, which grew in the earth, so:

EGG - CHICKEN - GRAINS - EARTH

- Aluminum can:
- Plastic bag:
- Leather shoes:
- Wooden chair:
- Cotton jeans:
- Newspaper:
- Steel scissors:
- Glass bottle:
- Hamburger:
- Can you name one thing that does not come from the earth?

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

After Dinner, More Than Leftovers!

Subjects: Language Arts, Social Studies, Environmental Studies

Time: 15 – 20 minutes

Focus: Packaging, Natural Resources

Concept: To become aware of natural resources consumed by packaging.

Learning Objective: To have students realize how excessive packaging in everyday items contributes to the waste stream.

Background: Our buying choices directly affect the amount of solid waste we generate.

Materials: Teacher's reference and student's worksheet "After Dinner, More Than Leftovers!"

Procedures:

1. Teacher distributes the student worksheet containing the following assignment: Imagine that you have to cook dinner for your family tonight. List every package or container you'll need to open in order to prepare the menu described.

2. Review students' answers, and using the teacher's reference sheet as a guide, discuss the packaging elements involved and the relationships between packaging, natural resources consumed to make the packages and the amount of waste we generate.

Teacher's Reference:

After Dinner, More Than Leftovers!

Imagine that you have to cook dinner for your family tonight. List every package or container you'll need to open in order to prepare the following menu:

- Chicken noodle soup:
  can or box with foil envelope inside
- Hamburger:
  styrofoam, cellophane wrap
- Roll or bun:
  plastic bag
- Ketchup:
  glass bottle or plastic squeeze jar, paper label
- Pickles:
  glass bottle with metal lid, paper label
- Tossed salad with dressing:
  cellophane lettuce wrapper, plastic bags for vegetables, glass bottle with plastic top, paper label
- Ice cream:
  cardboard box
- Cookies:
  cardboard box with waxed paper, foil liner or cellophane
- Milk:
  plastic jug or waxed cardboard

Think about it: What natural resources were used to make all these packages? Metal, tree, petroleum, silica, and fossil fuels used as energy for production.

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908

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Name: _____

After Dinner, More Than Leftovers!

Imagine that you have to cook dinner for your family tonight. List every package or container you'll need to open in order to prepare the following menu:

- Chicken noodle soup:
- Hamburger:
- Roll or bun:
- Ketchup:
- Pickles:
- Tossed salad with dressing:
- Ice cream:
- Cookies:
- Milk:

Think about it: What natural resources were used to make all these packages?

Will We Ever Run Out?

Subjects: Science, Environmental Studies

Time: 30 minutes

Focus: Natural Resources

Concept: Some of our natural resources cannot be replaced. When they are gone, they are gone forever.

Learning Objective: Students will learn to distinguish between items made from renewable and non-renewable resources.

Background: Some resources come from plants and animals which grow and reproduce. These can be replaced slowly if we use such resources wisely and plan ahead. If we cut down a tree to make lumber, paper or cardboard, we can plant a new tree. Since more trees can be grown, trees are called a renewable resource. Crops, animals and other things which can be replaced are renewable. But there are some resources which cannot be replaced. Limited amounts are found on the earth. When these are gone, there will be no more. These resources are non-renewable. When the last oil well runs dry, there will be no more oil to heat our homes, to drive our cars or to make all the plastic products that are now part of our lives. Minerals, fossil fuels, water and air are all non-renewable.

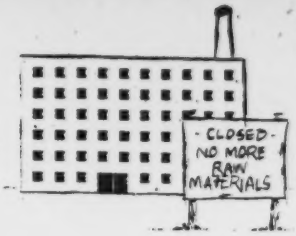
Materials: "Will We Ever Run Out?" Teacher's Reference and Student Worksheet.

Procedures:

1. Teacher distributes the worksheet to the students and asks them to identify the resource used to make each item listed. Is the resource renewable or non-renewable?

2. Students should mark an 'R' next to those items that are renewable. Mark an 'NR' next to the items made from sources that can't be replaced or are non-renewable.

Teacher's Reference:



Will We Ever Run Out?

Some resources come from plants and animals which grow and reproduce. These can be replaced slowly if we use such resources wisely and plan ahead for the future. If we cut down a tree to make lumber, paper or cardboard, we can plant a new tree. Since more trees can be grown, trees are called a renewable resource. Crops, animals and other things which can be replaced are renewable.

But some resources cannot be replaced. Limited amounts are found on the earth. When these are gone, there will be no more. These resources are non-renewable. We can't grow or make new copper or other precious metals. When the last oil well runs dry, there will be no more oil to heat our homes, to drive our cars or to make all the plastic products that are now part of our lives. Minerals, fossil fuels, water and air are all non-renewable.

Identify the resource that is used to make each item. Think about whether that resource can grow so that we will have more. Mark an 'R' next to those items that are renewable. Mark an 'NR' next to those items that are made from sources that can't be replaced or are non-renewable.

• cardboard box	tree - R	• aluminum pan	bauxite - NR
• steel bucket	iron - NR	• drinking glass	sand/silica - NR
• copper pipe	copper - NR	• steak	animal - R
• book	tree - R	• corn on the cob	plant - R
• leather jacket	animal - R	• wool sweater	sheep - R
• wooden desk	tree - R	• tire	oil - NR/rubber tree - R
• cotton shirt	plant - R	• diamond ring	diamond, gold - NR
• polyester shirt	oil - NR	• plastic wastebasket	oil - NR

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

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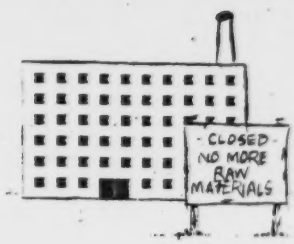


Will We Ever Run Out?

Some resources come from plants and animals which grow and reproduce. These can be replaced slowly if we use such resources wisely and plan ahead for the future. If we cut down a tree to make lumber, paper or cardboard, we can plant a new tree. Since more trees can be grown, trees are called a renewable resource. Crops, animals and other things which can be replaced are renewable.

But some resources cannot be replaced. Limited amounts are found on the earth. When these are gone, there will be no more. These resources are non-renewable. We can't grow or make new copper or other precious metals. When the last oil well runs dry, there will be no more oil to heat our homes, to drive our cars or to make all the plastic products that are now part of our lives. Minerals, fossil fuels, water and air are all non-renewable.

Identify the resource that is used to make each item. Think about whether that resource can grow so that we will have more. Mark an 'R' next to those items that are renewable. Mark an 'NR' next to those items that are made from sources that can't be replaced or are non-renewable.

- cardboard box _____
- steel bucket _____
- copper pipe _____
- book _____
- leather jacket _____
- wooden desk _____
- cotton shirt _____
- polyester shirt _____
- aluminum pan _____
- drinking glass _____
- steak _____
- corn on the cob _____
- wool sweater _____
- tire _____
- diamond ring _____
- plastic wastebasket _____

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908.

Section I
The Problem: Our Solid Waste Crisis

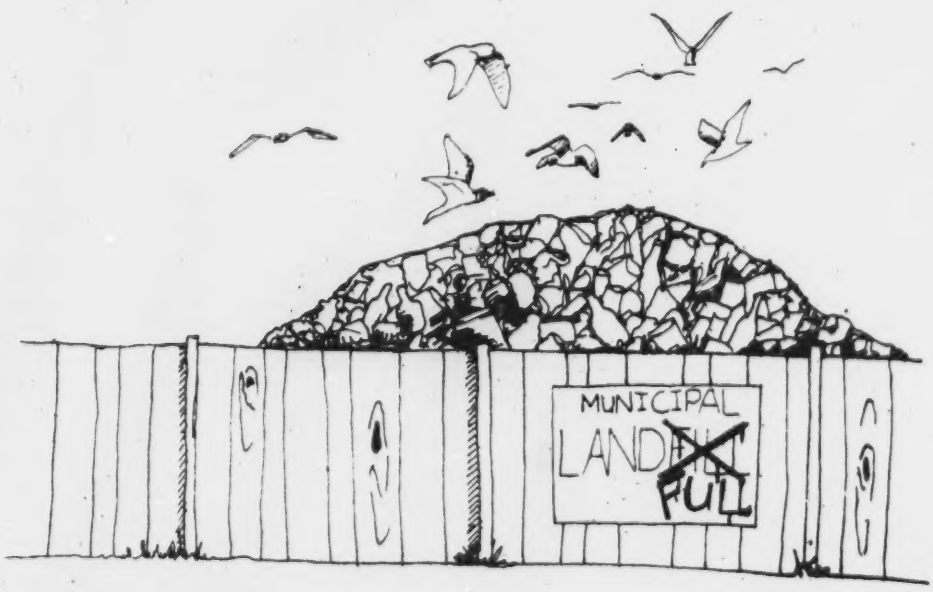
IV. Where Does it Go?

- Nowhere Is Away
- A Field Trip to a Waste-to-Energy Plant
- How Do Incinerators Work?
- How Do Landfills Work?
- Garbage Tales

Overview:

The final chapter in Section I offers insights on how we handle solid waste that isn't recycled or reused. Most of this waste goes into the nation's landfills, which are nearly at capacity, and much of the remainder is incinerated.

In these lessons, students learn how a modern waste-to-energy plant operates and gain an appreciation of the problems inherent in siting and managing a sanitary landfill. They explore how garbage gets to these sites, how trash is processed at each type of facility, and what end products result. The final lesson, *Garbage Tales*, provides a creative opportunity for students to pretend they are objects that have been placed in the trash. Each youngster composes his/her life story from origin through use and then disposal, or reuse.



Nowhere Is Away

Subjects: Social Studies, Math

Time: 30 Minutes

Focus: Waste Reduction, Landfills, Waste-to-Energy Plants

Concept: Expanding awareness of our waste problems will lead to changes in buying and disposing habits.

Learning Objective: Students will learn how they can help solve the problem of too much solid waste and the role played by landfills and waste-to-energy plants in managing solid waste.

Background: Each student discards about 1.3 pounds of waste each day at school. Each person in Connecticut discards about 5 pounds of waste a day. Annually, we discard more than a ton of household and industrial waste per day for each person in the state.

Materials:

- 5-pound bag of trash
- Pictures and articles about the solid waste problem
- Photos of a landfill or waste-to-energy plant

Procedures:

1. Teacher will bring to class a 5-pound bag of garbage or use a classroom garbage can.

2. Using the figures given above (and the bag of garbage), ask students how many pounds of garbage the class generates in one school day; in a 180-day school year? How may tons of garbage would the class generate at a rate of 5 pounds per day per student for a whole year? To gain a clearer understanding of the magnitude of a ton, have students total the weights of class members until a ton is reached.

3. Ask the class: Where does all this waste go? What problems does it create?

4. Augment the students' replies with these important statistics and the lessons of landfill, and waste-to-energy plants on the pages that follow:

    - Most waste goes into the nation's 15,000 landfills occupying 476,000 acres. (One acre is about 1-1/2 times the size of a football field.)
    - More than 60% of Connecticut's waste is incinerated, and the landfills that are being used are at or near capacity.
    - Finding sites for landfills and waste-to-energy plants is becoming increasingly difficult.
    - Disposing of waste is very expensive.
    - Groups of citizens protest when plants or landfills are located in their communities. They are called NIMBY (Not In My Backyard) groups.

5. Students should consider: What can you and I do to help solve this problem? Brainstorm possible solutions, including generating less waste (buying products that are not disposable or excessively packaged), recycling and reusing.

Adapted with permission from *A-Way With Waste*, Dept. of Ecology, 4350-150th Avenue, N.E., Redmond, Washington 98052

A Field Trip to a Waste-to-Energy Plant

Subjects: Science, Environmental Studies

Time: A Class Field Trip

Focus: Solid Waste Disposal – Waste-to-Energy Plants

Concept: Incineration is one of the strategies municipalities employ to dispose of waste efficiently.

Learning Objective: Students will understand how ordinary garbage is transformed into useful energy.

Background: Modern incinerators, or waste-to-energy plants, burn waste to generate energy. Such facilities use a variety of pollution control technologies, including scrubbers and filters.

Materials:
- Fact sheet – "How Do Incinerators Work?"
- Questionnaires developed by students in preparation for field trip

Procedures:

1. Arrange for a class field trip to a waste-to-energy plant. Call ahead and set up a time for your visit. (Be sure to follow all safety precautions while visiting the site.)

2. Prior to the trip, develop a list of questions the class might ask tour personnel. The questions might include some of the following:
   - How do incinerators work?
   - What are the benefits of incinerators?
   - What are the drawbacks to burning waste?
   - How does incinerator pollution control equipment work?
   - What temperature is maintained during incineration? Why?
   - How are incinerator ash and other byproducts handled?

3. Following the trip, have students write reports and draw pictures about what they saw. Students should present the reports and drawings to the class.

Adapted with permission from: Association of Vermont Recyclers, A.V.R.; P.O. Box 1244, Montpelier, VT 05602

How Do Incinerators Work?

Incinerators burn waste to reduce its volume. Incinerators can burn unprocessed waste (mass burn) or processed waste (refuse-derived fuel) and can be equipped to generate energy. Incinerators so equipped use the heat from burning garbage to convert water to steam, which is then either fed into a steam-loop or district heating system or used to turn turbines to generate electricity.

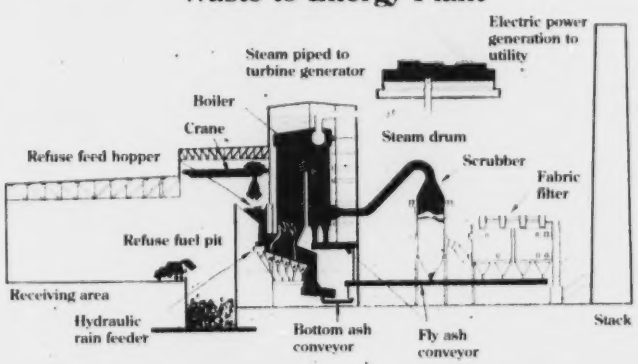
Modern facilities use a variety of pollution control technologies to reduce toxic materials emitted in smoke. Among these are scrubbers, which spray a compound into the smoke that helps neutralize acid gases, and filters, which remove tiny ash particles from the smoke. Burning waste at extremely high temperatures is another way to destroy harmful chemical compounds and disease-causing bacteria.

Mass-burn facilities are convenient from a solid waste management perspective. There is no pre-processing of waste, and no changes need to be made in the way most municipalities collect trash. When trucks enter a waste-to-energy facility, their loads are weighed and the trash is delivered to a tipping platform. Front-end loaders and cranes push the waste down a shoot or hopper and feed it into a combustion chamber. The residual ash from the combustion chamber (bottom ash), and that collected by pollution control equipment (fly ash), is deposited into large covered dumpsters that are hauled away to a lined landfill.

The primary advantage of burning waste is a reduction in the amount of trash — up to 90% in volume and 75% by weight. In addition, burning waste creates energy through the heat emitted in combustion. In 1989, modern waste-to-energy facilities generated enough electricity to supply 1.2 million households for a year.

With the increasing cost of landfills, combustion is becoming a more economical alternative, despite the very high cost of constructing waste-to-energy facilities.

Waste-to-Energy Plant



Adapted with permission from: Association of Vermont Recyclers, (A.V.R)., P.O. Box 1244, Montpelier, VT 05602

How Do Landfills Work?

Subjects: Science, Social Studies

Time: Several Class Periods, A Field Trip

Focus: Solid Waste Disposal, Landfills

Concept: Some of Connecticut's solid waste is disposed of in landfills, but landfills are filling up and polluting our environment.

Learning Objective: Students will learn where their garbage goes, how a sanitary landfill works and some of the associated pollution problems.

Materials: Questionnaires developed by students in preparation for field trip.

Background: As the hazards of open dumping have become better known, landfill designs and rules have changed to better protect public health and the environment. Open burning is no longer allowed. Wastes are spread out, compacted and covered frequently with several inches of soil to reduce odor, control litter, insects and rodents, and protect public health. Liners and leachate (liquids that percolate through landfills) collection systems are installed to protect ground and surface water from contamination. Fencing is erected to control litter and prevent illegal dumping. When the site reaches capacity, it must be covered with a thicker layer of soil and landscaped. Provisions must also be made for the safe release of methane gas, continued collection of leachate, and monitoring of ground water.

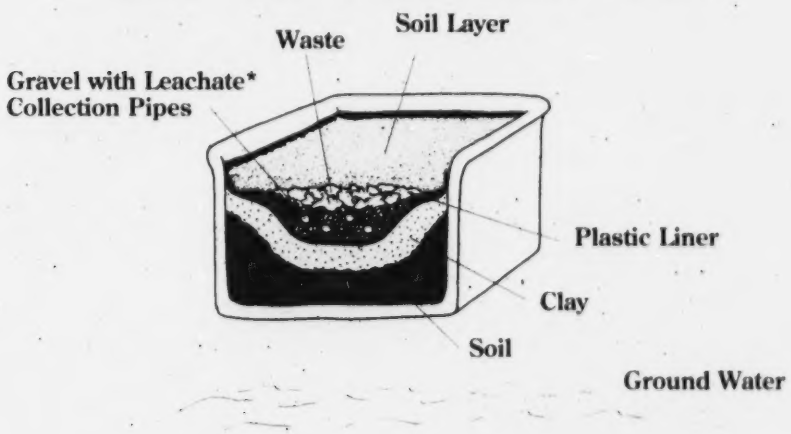
Procedures:

1. Take a field trip to a local landfill. Call ahead and set up a time for your visit. (Be sure to follow all safety precautions while visiting the site.)

2. Have students develop a list of questions to ask landfill personnel. Include some or all of the following questions:

   - Where is garbage from our homes and school taken?
   - How does it get there?
   - Why is the landfill located at this site? What factors must be considered when a site is selected?
   - What tests were done at the site before it was opened? What were the results?
   - Who does the site serve? Who can bring waste to the landfill?
   - How much solid waste is disposed of at this site daily, weekly and annually?
   - What happens to the garbage once it is dumped in the landfill?
   - Are any of the materials hazardous? Are there regulations or procedures for dealing with hazardous wastes?
   - How many years is the landfill expected to last? How much time is necessary to find and prepare a new site? Does the community have land for a new site or must we find another solution? What could that solution be?

"Bathtub" Model of Modern Sanitary Landfill



***Leachate**– Liquid that has seeped through solid waste and/or has been generated by solid waste decomposition, which has dissolved or suspended materials in it. This liquid may contaminate ground or surface water.

Adapted with permission from Association of Vermont Recyclers (A.V.R.), P.O. Box 1244, Montpelier, VT, 05602

Garbage Tales

Subjects: Language Arts

Time: One Class Period

Focus: Disposal of Garbage

Concept: There is no easy solution to waste disposal.

Learning Objective: Students will apply their knowledge of natural resources, consumption and conservation to a creative writing project.

Background: The earth is the source of everything we make, use and throw away.

Materials:
Student worksheet "Garbage Tales"
Pencils
Markers
Crayons

Procedures:

1. Teacher should distribute the student worksheet "Garbage Tales." Encourage students to think of creative responses. Stress steps involved in production as well as consumption.
2. Ask students to pretend they are objects that have been thrown in the trash can. Then ask them to write their life story: How they were made, used and finally discarded.
3. Read compositions and discuss in class, listing implications for conserving and recycling our resources.

Name: _____

Garbage Tales

Pretend that you are an object that has been discarded in the trash can. Write your life story: How were you made or grown? How were you used? How did you end up in the trash? What do you think will happen to you now? Where do you think you will go?

Portrait of:

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908

Section II
Solutions: We Can Make a Difference

V. We Can Make a Difference

- Solid Waste Bulletin Board
- Consumers/Conservers

Overview:

There is no single solution to the problem of solid waste management. Communities must combine source reduction, recycling, reuse, incineration and landfills to help manage this social and environmental problem. Section II deals with the strategies we can employ to resolve the solid waste crisis.

In this chapter, students learn to limit solid waste by remembering the three R's. They also commit to take action in their homes and school to: *Reduce* the quantity of waste produced through source reduction (or precycling), *Reuse* items (plastic soda bottles can be used to carry water or can be made into classroom terrariums or bird feeders), and *Recycle* whenever possible.

Source reduction (or precycling) means reducing the amount of waste each of us creates. This can be accomplished by minimizing the consumption of products and packaging and extending the useful life of products. By realizing that purchases relate directly to waste generation, students learn that they can reduce waste before it enters their homes or school by buying smart and avoiding items which are excessively packaged or disposable.

Precycling through selective shopping will also decrease household garbage, save money and extend the life of our landfills. At the grocery store, students can precycle by choosing items with the least packaging per volume of product. Some examples include: Buying lunch snacks in bulk rather than in individual packages, packing lunch snacks in reusable containers, buying food or beverages in large cans and dividing the contents into reusable containers and freezing them, buying concentrated products whenever possible, purchasing sodas and fruit drinks in returnable bottles or recyclable cans.

The final lesson in the chapter includes a Family Contract. Students are asked to discuss and sign the Contract with their families. The Contract commits them to take specific actions that conserve rather than consume resources.

Solid Waste Bulletin Board

Subjects: Social Studies, Science

Time: Utilize Throughout Unit on Recycling

Focus: Solid Waste

Concept: What we choose to do with our trash will have an impact on our lives and our environment.

Learning Objective: Students will evaluate activities they can engage in to promote preservation of resources and make lifestyle choices that they can commit to.

Background: We can treat our solid waste in four ways: 1) reduce it, 2) reuse it, 3) recycle it or 4) recover the energy it can produce. Reduce means to change our attitudes and purchasing habits by avoiding excessive packaging and disposables. Reuse means to use again. Recycle means to collect used products and make them into new items. Recover means to produce energy by burning trash.

Materials:
Bulletin board
Thumbtacks

Procedures:

1. Teacher introduces the concepts of reduce, reuse, recycle and recover to decrease waste.
2. Ask the students to list activities that each of them can engage in to utilize each of these concepts. List the activities on the bulletin board (for examples, see page 47).
3. For each activity, students should decide whether they can commit to changing their lives in that fashion all of the time, some of the time or never. Have them indicate their choices on the bulletin board.
4. Ask students to maintain a diary for a week or longer to record actual activities they have implemented and to share these with the class.

Adapted with permission from Association of Vermont Recyclers' *Teacher's Resource Guide for Solid Waste and Recycling Education*, (A.V.R.), P.O. Box 1244, Montpelier, VT 05601.

I can't	I don't want to	I might	I'll do it sometime	Easy, I'll do it	
					walk instead of asking for a ride
					ride a bike instead of asking for a ride in the car
					throw papers in trash cans
					uses dishes instead of paper plates and paper cups
					save newspapers for recycling
					use the back of writing and drawing paper
					save envelopes and wrapping paper to use again
					save cans and bottles for recycling
					use plastic bags over and over
					avoid buying things in plastic containers or wrappers
					turn off all water faucets tightly
					fix drips and leaks
					don't let water keep running when you brush your teeth
					run dishwashers and washing machines only with full loads
					don't use the toilet as a wastebasket
					turn off lights when you are not using them
					plant trees
					fix things instead of throwing them out
					give outgrown clothes to someone smaller
					share books and games with your friends
					talk to people about ecology

Consumers/Conservers

Subjects: Environmental Studies, Science, Social Studies

Time: One Class Period

Focus: Resource Conservation

Concept: As consumers, we can make wise choices that will help conserve our resources.

Learning Objective: Students will determine what things can be used only once and which ones can be used many times over. They will determine what products may be substituted for the disposable items.

Background: Americans, on a per person basis, consume far more energy, food and other natural resources than people in other parts of the world.

Materials: "Consume/Conserve" student worksheet, teacher's reference and "The Family Contract."

Procedures:

1. Write "Consume" and "Conserve" on the board. Have students attempt to define both terms and provide examples of things they consume or conserve. Compare the length of the two lists and discuss the fact that we consume more than we conserve.

2. Distribute the "Consume/Conserve" worksheet and instruct students to complete it independently. Discuss their solutions (see teacher's reference) and suggestions in light of the fact that there aren't any "right" answers, just trade-offs and values to be weighed as we consume different natural resources.

3. Distribute the "Family Contract." Ask students to bring the contract home, read and discuss it, and then fill it out with their family. Discuss the activities agreed to in class. Post the Contracts on the bulletin board. Periodically ask students to provide examples of how their families are implementing their Contract.

Adapted with permission from *Oscar's Options*, Ocean State Cleanup and Recycling, Department of Environmental Management, Providence, RI 02908

Teacher's Reference:

Consumers/Conservers

You are a **consumer!** Consume is a verb that means "to do away with completely." When you consume something you use it up, eat it, wear it out or finish it. In your lifetime, you have consumed hundreds of peanut butter sandwiches, gallons of water and dozens of pairs of socks.

List some of the things that you personally consume in only one use (for example, your carton of milk at lunch or a piece of paper you've drawn a picture on).

paper products, food, toothpaste, gasoline, electricity

List some things that are used many times before they are consumed (such as your shoes or a coloring book).

toothbrush, hairbrush, clothing, television, car, games, furniture, computer, telephone

You can **conserve.** Conserve means to preserve, keep safe or use wisely. You are a conserver when you are not wasteful.

List some things that are made to be used only once and then thrown away.

paper towels, soda cans, bottles, paper napkins, packaging, paper plates, plastic silverware, newspapers, disposable diapers, plastic trash bags, disposable pens

Look at your list. Suggest other products or uses that might do the same job while conserving our resources.

cloth towels, recycled containers, cloth napkins, more thoughtful (less) packaging, china, metal silverware, cloth diapers, trash cans, refillable-cartridge pens

Are there some changes that **You** can make in your lifestyle that would conserve our resources? List them!

Recycle glass food and beverage containers, metal food and beverage containers, newspapers, and ⚠ and ⚠ plastics. Buy food and beverages in large cans and store in reusable containers. Pack lunches in reusable containers. When shopping, choose items that are minimally packaged. Encourage parents to bring their own reusable canvas or net bags to the grocery store, choose a shower instead of a bath and always turn the water off when brushing your teeth.

Name: _____

Consume/Conserve: The choice is yours!

You are a consumer! Consume is a verb that means "to do away with completely." When you consume something you use it up, eat it, wear it out or finish with it. In your lifetime, you have consumed hundreds of peanut butter sandwiches, gallons of water and dozens of pairs of socks.

List some of the things that you personally consume in only one use. (for example, your carton of milk at lunch or a piece of paper you've drawn a picture on.)

_____

List some things that are used many times before they are consumed. (such as your shoes or a coloring book).

_____

You can **conserve**. Conserve means to preserve, keep safe or use wisely. You are a conserver when you are not wasteful.

List some things that are made to be used only once and then thrown away.

_____

Look at your list. Suggest other products or uses that might do the same job while conserving our resources.

_____

Are there some changes that **You** can make in your lifestyle that would conserve our resources? List them!

_____

Family Contract

Please discuss the 3 R's (described below) with your family. Decide together ways you can reduce, reuse and recycle and then fill out the Family Contract found on the next page. (Hint: don't take on too much all at once. Habits are difficult to change. You can always revise your agreement later.)

■ **Reduce:** Buy durable, repairable products. Buy fewer disposable items. Buy items with minimal packaging. Avoid eating at carry-out restaurants that over-package food or try asking the restaurant for less wrapping. Buy food in bulk and store in glass jars. Reduce purchases of non-recyclable items. Request "no bag" for small purchases. Use your library instead of buying all your books.

■ **Reuse:** Use cloth kitchen towels and cloth napkins. Reuse small plastic bags, glass jars or plastic containers for left-over food. Bring reusable canvas and net bags on your next shopping trip. Carry your own coffee mug. Give outgrown clothes and unwanted items to charities. Write notes on used envelopes and scrap paper. Use comics for wrapping paper. Return extra hangers to dry cleaners. Compost your organic waste. Try to repair rather than replace broken appliances.

■ **Recycle:** Buy recycled and recyclable products. Reduce junk mail by up to 75% by writing to: Mail Preference Service, Direct Marketing Association, 6 East 43rd St., New York, NY 10017, and ask to be eliminated from all mailing lists in the future. Write or call companies directly to be removed from existing mailing lists. (Many companies have toll-free numbers or postage-paid envelopes.)

Adapted with permission from *Waste Away*, Vermont Institute of Natural Science, P.O. Box 86, Woodstock, VT 05091.

We the undersigned agree
to practice the three R's:

Reduce, Reuse & Recycle!

Our family agrees to work
together to reduce our
production of trash by
doing the following things:

_____

_____

_____

_____

_____

_____

Signed & Dated:

_____

_____

_____

_____

_____

Waste Away - Info and Activities for Investigating Trash Problems and Solutions, Vermont Institute of Natural Science, P.O. Box 86, Woodstock, VT 05091

Section II
Solutions: We Can Make a Difference

VI. Reduce

- Packaged Picnic
- Not in My Shopping Cart
- Pondering Packaging

Overview:

Reduction is the first of three strategies to manage the solid waste crisis. The lessons in this chapter deal primarily with packaging. Students will gain an understanding of what constitutes excessive packaging, explore alternatives to multi-layered packaging and learn to take action to effect change in the marketplace.

In *Packaged Picnic*, groups of students assemble picnic baskets, contrasting foods that are both sensibly packaged and over-packaged. *Not in My Shopping Cart* carries this lesson one step further. Students bring packaging materials to class and suggest ways each product could be packaged differently to conserve resources and reduce garbage. *Pondering Packaging* takes a creative approach to the same issue. Students design their own packaging alternative for a common grocery or hardware store product.

THINK BEFORE YOU BUY!

- Buy reusable items instead of disposable ones.
- Buy items with the least packaging, or recyclable packaging.
- Buy in bulk

Packaged Picnic

Subjects: Language Arts, Social Studies, Science

Time: One Class Period

Focus: Waste Reduction

Concept: To become aware of adequate versus excessive food packaging.

Learning Objective: Students will become aware of adequate versus excessive packaging and which packaging materials are preferable from an environmental perspective.

Background: Choosing products in packages that can be reused or recycled and avoiding disposable and excessively packaged goods will significantly reduce the amount of solid waste we are generating.

Materials:
Variety of food packages
Eating utensils
Paper
Pencils
Fact sheet "Packaging — What Purpose?"

Procedures:

1. Divide the class into groups of four or five students. On a table, display a wide variety of food packages and utensils, including examples of both adequate and excessive packaging. Ask half of the groups to plan a picnic choosing the adequately packaged foods and eating utensils. Ask the remainder to plan a picnic using the excessively packaged products.

2. Allow time for each group to describe their picnic choices to the rest of the class. Discuss packaging alternatives. What becomes of packaging?

3. Using the fact sheet "Packaging — What Purpose?," outline on the chalkboard the benefits and problems caused by packaging.

Adapted with permission: *Waste Away*, Vermont Institute of Natural Science, Woodstock, VT. 05091

Packaging — What Purpose?

- **What purposes does packaging serve?**
  Packaging makes possible national marketing and distribution of goods. It protects contents from damage, spoilage and contamination. It provides convenience in handling, identifies contents and may furnish directions for use.

- **In what ways is packaging a problem?**
  Packaging contributes to the volume of solid waste, depletes limited resources, adds to litter and pollution, and increases the cost of a product. Some packaging materials are not biodegradable or contain toxic materials that are harmful to the environment.

- **What is excessive packaging?**
  Excessive packaging is packaging that is not required to protect its contents from damage or spoilage but is employed solely for ease of handling or to market a product attractively.

- **What is harmful packaging?**
  Harmful packaging is packaging that, either through its manufacture or use, injures the health of humans, animals, plants or the environment. Such packaging rarely remains in use (at least in the U.S.) once a scientific consensus develops that it is harmful. However, it often takes years for such a consensus to develop. It took two decades for consensus to be achieved on the harmful effects of chlorofluorocarbons (CFCs) used in manufacturing polystyrene.

- **How can excessive or harmful packaging be reduced?**
  Encourage packaging manufacturers and large packagers to voluntarily reduce packaging and undertake research to develop less harmful, wasteful packaging. Packaging regulation by federal and state governments also can reduce excessive or environmentally harmful packaging and promote the use of reusable and recyclable packaging. Such regulation may take the form of deposits, taxes, labeling, regulatory review, bans on specific packages, financial incentives (tax breaks or penalties) and packaging standards.

- **What makes a good package?**
  For consumers, a "good" package is easy to carry, open and reseal. It is inexpensive, protective, convenient, nonbreakable and reusable. For manufacturers, a "good" package sells a product, protects its contents, won't break and is easy to handle. It is lightweight to reduce the cost of shipping. For retailers, a "good" package is difficult to steal or damage, convenient, holds up well in storage and maintains an attractive appearance in artificial light. For solid waste managers, a "good" package is reusable, refillable, recyclable, biodegradable and/or compactible.

Adapted with permission: Association of Vermont Recyclers (AVR), P.O. Box 1244, Montpelier, VT 05602

Not In My Shopping Cart

Subjects: Home Economics, English

Time: 30 Minutes

Focus: Waste Reduction, Non-renewable Resources

Concept: Valuable raw materials and energy go into producing packaging, which frequently is used only once.

Learning Objective: Students will gain an understanding of the purpose of packaging. They will learn to identify wasteful packaging, products packaged in recycled materials and steps that can be taken to influence packaging options.

Background: Nearly $1 out of every $10 spent for food and beverages in the U.S. pays for packaging. In industrial countries, packaging comprises about 30% of the weight and 50% of the volume of household waste.

Materials: Packaging made from:

- aluminum
- glass
- paper
- plastic
- wood
- other metals

Procedures:

1. Ask students to bring examples of packaging to class.

2. Discuss the following:

   - Which products need the protection of packaging?
   - Which products need packaging to protect public health, prevent theft, provide advertising or facilitate handling and shipping?
   - Which packaging is recyclable?
   - How can you identify packaging made from recycled materials? (Look for the recycling emblem. Also, gray paperboard is probably made from recycled paper.)
   - Is any of the packaging unnecessary or excessive?
   - Which products can be sold in bulk instead of in individual portions?
   - What is the advantage of larger quantity packaging? (A 3-oz. tube of toothpaste uses 50% more packaging per ounce than a 7-oz. tube.)

BEST COPY AVAILABLE

- Could the package be made in a way that conserves more resources or energy?
- Could this product be packaged in fewer materials?

3. Ask the students to suggest ways to package and market products that preserve natural resources and protect the environment. Teacher should list their suggestions, including some of the following, on the chalkboard:

   - Avoid products packaged in non-recyclable plastic containers. Find out which plastics are recycled in your area, and buy products packaged in these containers. Buy products in packaging made from renewable resources, like paper, or in recyclable materials, like glass, aluminum and metal.
   - Buy fewer prepackaged and pre-cooked foods. Cooking from scratch saves energy, costs less and often is more nutritious.
   - Choose durable shopping bags, string bags and knapsacks.

4. Solicit class suggestions on ways to encourage producers and retailers to be more conscious of the environment. Ask each member of the class to undertake one of the following activities and share the response they receive with their classmates:

   - Complain to retailers about specific products that are overpackaged.
   - Encourage retailers to stock returnables and recyclables (e.g. glass milk containers).
   - Ask legislators to support container standards that expand the use of returnable, reusable packaging.
   - Write to manufacturers suggesting changes in the amount of packaging they employ.
   - Write to packaging companies urging the use of recycled and recyclable materials.

Adapted with permission from: *A-way With Waste*, Washington State Department of Ecology, 4350-150th Avenue NE, Redmond, Washington 98052.

Pondering Packaging

Subjects: Social Studies, Science

Time: One Class Period

Focus: Resource Conservation

Concept: Excessive packaging contributes to waste.

Learning Objective: Students will assess the impact of excessive packaging and brainstorm alternatives.

Background: An estimated 33% to 44% of solid waste in the U.S. is packaging — more than 44 million tons each year. Packaging that protects food from spoilage and damage during shipping is beneficial, but too much packaging is wasteful. Some packaging can be recycled or composted. Packaging made from plastic or multi-layered material is not reusable or recyclable.

Materials:

- Aseptic juice boxes
- Disposable razor in plastic bag
- Individually wrapped hardware
- Cheese wrapped by the slice
- Fruit in styrofoam and plastic film
- Other examples of excessive packaging

Procedures:

1. Divide the students into groups. Give each group one example of excessive packaging. Have students record the different kinds of packaging material used with their product. Why was this type of material used? Was it necessary? Is it recyclable or reusable?
2. Ask each group to design an alternative package for their product.
3. Make a display that contrasts the original packaging with the designs the class produces.

Extended Learning:

- Have the class identify examples of well-designed packaging. Students should explain why each is environmentally sound.
- Invite a packaging industry representative and an environmentalist to class to present opposing views of packaging.
- Reuse packaging materials in a collage or sculpture.
- Make a bulletin board comparing natural and man-made packaging.

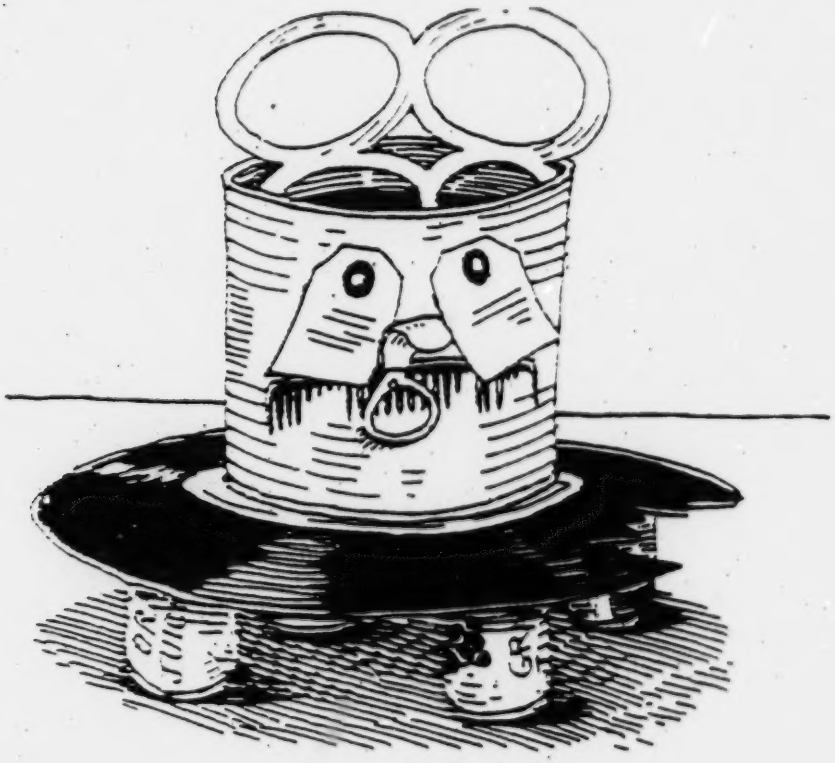
Adapted with permision: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier VT. 05602

Section II
Solutions: We Can Make a Difference

VII. Reuse

- Trash or Treasure
- The Art of Solid Waste

Overview: Reuse is the second strategy to manage the solid waste crisis. In these lessons, students learn that what one person considers trash, another may regard as treasure. Through invention, poetry, collage, photography and sculpture, students explore the value of reusing objects in original ways.



Graphic adapted with permission from: *A-way With Waste*, Washington State Department of Ecology, 4350-150th Avenue, NE, Redmond, Washington 98052.

Trash Or Treasure

Subjects: Language Arts, Art, Social Studies

Time: One Class Period

Focus: Waste Reduction, Reuse

Concept: One person's trash is another person's treasure.

Learning Objective: Students will redefine waste as a resource by identifying how trash can be converted to treasure.

Background: We can reduce waste by finding new uses for things we used to throw away.

Materials:

- Examples of reused objects
- Used objects from students' homes
- Worksheet "Don't Throw Away a Good Thing"

Procedures:

1. Show the class two examples of reused objects: an object that is being reused for its original purpose and an object for which a new use has been found.

2. Ask the students to bring to class a treasured object they have rescued from the trash. It may be something they have reused either for the same or for a new purpose. If they cannot find one, ask them to bring an object that they plan to reuse in an original way. Have the students show their objects to the class and explain why they are treasured.

3. Discuss the benefits of reusing things. Bring out the facts that it is fun, creative, saves money, conserves space in our landfills, helps reduce pollution and preserves natural resources.

4. Pass out the worksheet "Don't Throw Away a Good Thing." Ask the students to locate the hidden words. Point out that the items circled may be recycled or reused.

Extended Learning:

- Ask the students to imagine and describe a planet full of creatures who consider the things we throw away to be their most treasured possessions. Instruct them to write a story or poem on one such creature and its treasure.

- Organize a class or school swap day where students exchange trash for treasure.

- Have students use old greeting cards to construct new ones.

Adapted with permision: Association of Vermont Recyclers (A.V.R.), P.O. Box 1244, Montpelier VT. 05602

Name: _____

Don't Throw Away a Good Thing

Save 18 valuable things from the landfill or incinerator. Circle in **RED** the things that can be **recycled.** Circle in **BLUE** the things that can be **reused** (some may be both).

C O M P U T E R P A P E R S M O P R
Q M T R E D U C E S C F Y G L T U E
A L T J K S V B E D X T I R K M T S
B L U I X L M V G I F T W R A P I G
O L P G R F A L U M I N U M C A N S
T C A D H E J K H L Z Y N M P O C P
T B P V L X S Z I U Y T S W E R A H
L A E S D F B V T C P E P O I U N O
E R R Y A S D V C O I L X Z O K S N
S E E I G R O C E R Y B A G S J N E
R P G H B Y G V E T F S C S R D X B
E A G S Z W A T Q R E U S E T Q A O
C P C W S X T E D M O T O R O I L O
Y S A G L A S S J A R S R F Y T C K
C W R B B Y H N U J M Z A W Z S X S
L E T F P L A S T I C B A G S V B H
E N O G R A S S C L I P P I N G S M
K O N M I L K J U G S W D R E S O J
V E S B F C L I P C A N M Y Z O X V

LEAVES	NEWSPAPER	BOTTLES
MILK JUGS	GLASS JARS	GROCERY BAGS
ALUMINUM CANS	TIN CANS	PAPER EGG CARTONS
PLASTIC BAGS	MOTOR OIL	PHONE BOOKS
GRASS CLIPPINGS	GIFT WRAP	COMPUTER PAPER
BATTERIES	TIRES	TOYS

Find three extra bonus words and write their message below.

The Art of Solid Waste

Subjects: Art, Social Studies

Time: One – Two Class Periods

Focus: Solid Waste, Recycling, Art History

Concept: Solid waste may be used to create art work that will make people more aware of the need to recycle.

Learning Objective: Students will learn to use recyclables in an artistic manner to spread the message of recycling to their community.

Background: Items we discard can be used in creative, new ways. Students can influence members of their community to conserve resources.

Materials:

- Aluminum cans
- Glass bottles
- Paper
- Plastic milk bottles
- Other recyclables

Procedures:

1. Discuss the elements of design that may be perceived in everyday objects: line, form, shape, color.
2. Ask the students to research and bring in examples of art made from everyday objects. Discuss how reducing our solid waste requires looking at waste in new and creative ways, just as these artists have.
3. Ask the students to collect recyclables and use these to make a collage or sculpture containing a message advocating the need to recycle.
4. Display student constructions in school showcases and local libraries.

Extended Learning:

■ Show students photographs of sculptures made from waste in "The Fascinating World of Trash," National Geographic, April 1983.

Adapted with permission from: *A-way With Waste*, Washington State Department of Ecology, 4350-150th Avenue NE, Redmond, Washington 98052.

Section II
Solutions: We Can Make a Difference

VIII. Recycle

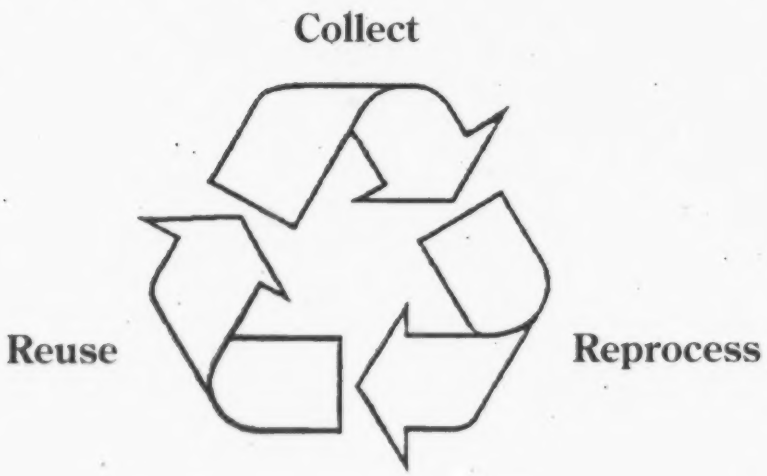
- Recycle Bicycle
- How Does Recycling Work?
- Papermaking

Overview: The third strategy, recycling, is a loop that involves collecting materials (glass, metal, paper, plastic) and processing and manufacturing them into new products. Recycling is beneficial because it:

- reduces the amount of solid waste requiring disposal;
- preserves natural resources, including non-renewable resources like petroleum;
- conserves energy utilized in manufacturing new products; and
- reduces pollution.

In these lessons, students learn how recycling is similar to natural cycles by taking a product out of the waste stream and reusing it again and again in new forms. As a practical example, students learn how to make a recycled sheet of paper.

As a culmination of this unit, teachers may wish to undertake an ambitious project, such as a school-wide recycling program. Refer to the Appendix for a description of how to go about organizing and carrying out a program of this nature.



Recycle Bicycle

Subjects: Art, Language Arts, Social Studies

Time: 15 to 30 Minutes

Focus: Recycling

Concept: Students who understand recycling will be motivated to recycle at home.

Learning Objective: Students will learn that recycling conserves resources that would otherwise enter the waste stream, and saves energy that would be used in manufacturing new products.

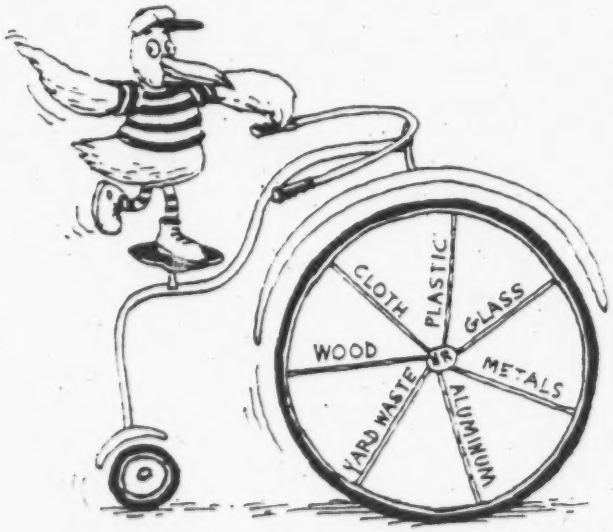
Background: When we recycle, we conserve resources that would end up in landfills or incinerators.

Materials:

- Glass bottle
- Plastic soda bottle
- Newspaper
- Tin can
- Aluminum can

Procedures:

1. Draw a circle on the chalkboard. Point out that the circle is continuous. Compare it to cycles in nature that are also continuous: the water cycle and the seasons of the year.



2. Ask the students to list objects they commonly throw away, and have them bring in some examples. Classify these into groups: cloth, wood, plastic, glass, metals, aluminum, yard waste. Explain that each student has a choice, either to discard these things or start a cycle of reuse or recycle.

3. Write the word "recycle" on the board. Next to it draw a bike wheel with spokes. Write the word "bicycle" above it. Ask the children how these two words are similar.

4. Label each spoke of the bicycle wheel with the name of one of the categories the students specified above. Label the hub "natural resources." Draw a person on the rim to indicate that each individual has a choice either to recycle, reuse, or discard the material.

5. Hold up each of the items the students brought in. Ask what natural resource it came from. List on the board the product and the resource from which it was derived (plastic-petroleum, newspaper-tree, etc.). Ask the children to research and write reports on the steps involved in manufacturing each of the items.

Extended Learning:

■ Have students give a presentation using artwork, photography, or drama on a product's complete cycle from natural resource to manufactured object. Point out the importance of continuing the cycle through recycling.

Adapted with permission from: *A-way With Waste*, Washington State Department of Ecology, 4350-150th Avenue NE, Redmond, Washington, 98052.

How Does Recycling Work?

Subjects: Language Arts, Social Studies

Time: One Class Period

Focus: Recycling

Concept: Everything we make, use or throw away comes from and returns to the earth.

Learning Objective: Students will trace objects from their source to the consumer and back again.

Background: Students will examine and trace the life cycles of common household objects.

Materials:

- Common household objects that students bring to class
- Fact sheets:
  - "Waste Disposal and Recycling Program"
  - "How Are Plastics Recycled?"
  - "How Is Glass Recycled?"
  - "How Are Aluminum Cans Recycled?"
  - "How Is Paper Recycled?"

Procedures:

1. Ask each student to bring to class a common household object made from only one material (rubber eraser, glass jar, piece of paper, plastic bag). Have students identify the natural resources used and the procedures employed to manufacture and deliver the object to the consumer.

2. Discuss the different steps required to produce things we use each day. How many times is the object transported in its lifetime? By what means? What fuel is used? Is the object easily reusable? Is it easily recyclable? What are the environmental effects of producing and transporting the object?

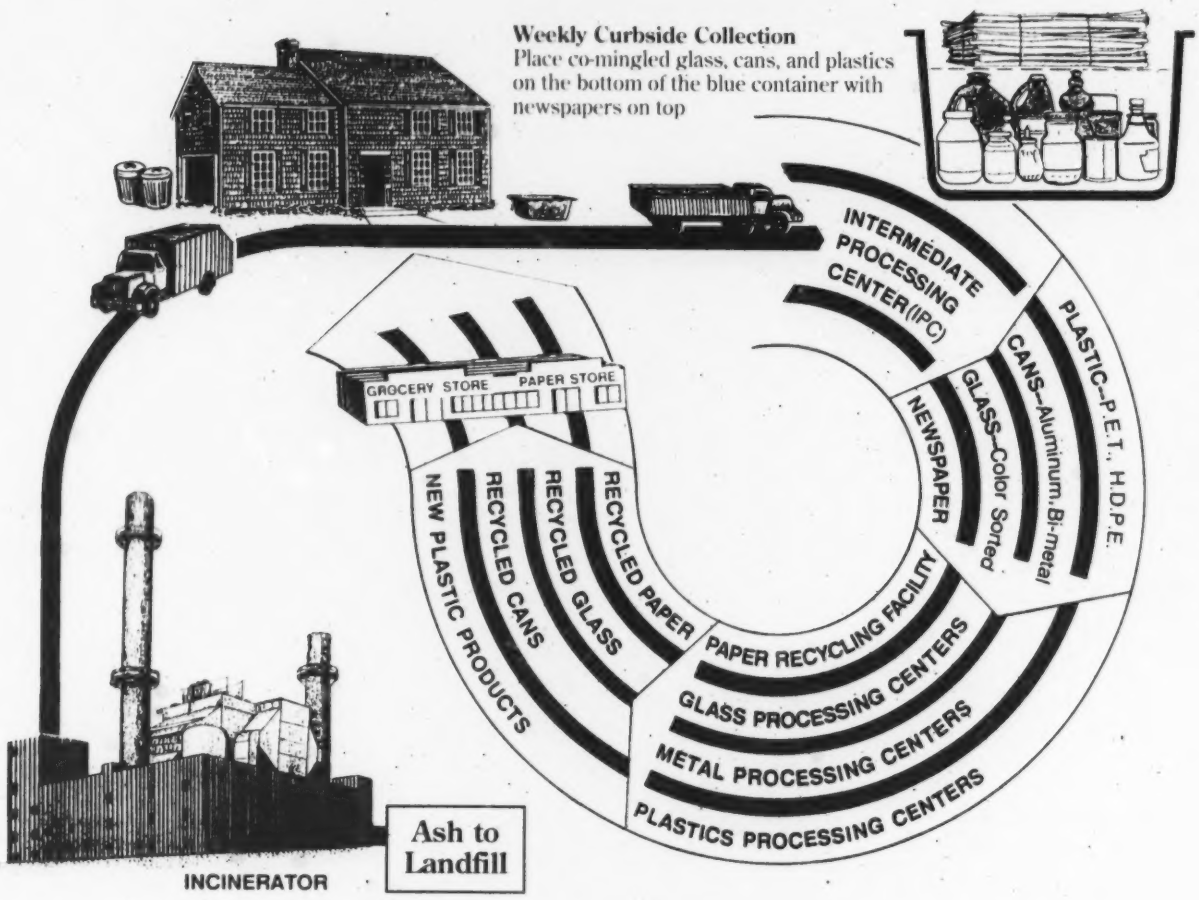
3. Next, trace all the steps needed to recycle the product into another useful object. Use the accompanying fact sheets on recycling of plastic, glass, aluminum and paper as references. Illustrate the life cycle of the products the students brought to class.

Extended Learning:

■ Have students role-play the life cycles of various products (a recycled product, a product sent to an incinerator or a landfill, a product made from natural or renewable resources versus one made from synthetic material).

Adapted with permision: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier VT. 05602

Waste Disposal and Recycling Program



Adapted with permission from: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier, VT 05602

How Are Plastics Recycled?

Plastics must be sorted by resin type (The quality of recycled plastic depends on how well the scrap is separated prior to recycling). Then the plastic is baled or shredded and shipped to a re-manufacturing plant.

Soda bottles, with a number 1, are shredded into fibers and used to stuff sleeping bags, quilts and parkas. They are also woven back into thread to make clothing.

Plastic milk jugs, juice jugs, bleach bottles and detergent bottles, with a number 2, are also recyclable. They are commonly made into construction materials, such as railroad ties, parking blocks, piping and beams, park benches and fence posts.

Because food particles can contaminate plastic molecules, recycled plastic cannot be used for food containers. However, it can be used as filler in food packaging, so long as it does not come into direct contact with the food.

Adapted with permission from: Association of Vermont Recyclers, (A.V.R.),P.O. Box 1244, Montpelier, VT 05602.

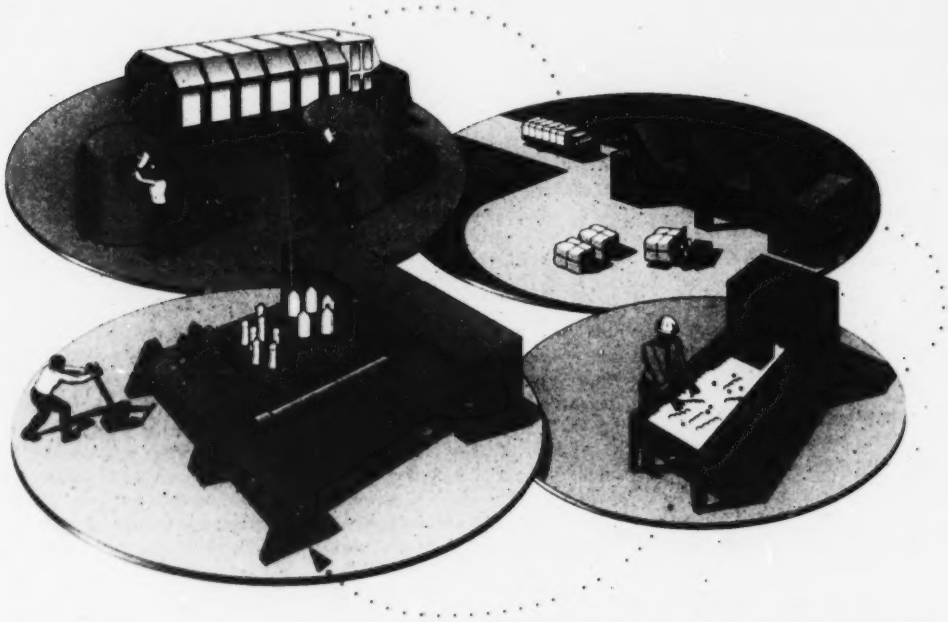
The Four Steps of Plastics Recycling

COLLECTION

Rather than being thrown away after serving their initial purpose, plastics are collected for recycling.

HANDLING

Collected plastics are sorted to increase quality and compacted to reduce cost.



RECLAMATION

Plastics are cleaned and converted to flakes or pellets, or in some cases, new products.

END - USE

Reclaimed plastics or end products—bottles, egg cartons, carpeting, lumber and more—are marketed.

Plastics graphic courtesy of Council for Solid Waste Solutions, 1275 K Street, N.W., Suite 400, Washington, D.C. 20005

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How Is Glass Recycled?

To prepare glass for recycling, rinse containers, remove aluminum and plastic caps. (Window glass, ceramics, pyrex, light bulbs, mirrors and glass that is not used in containers should not be included. Their varied chemical composition results in visual inconsistencies and structural imperfections in new glass.)

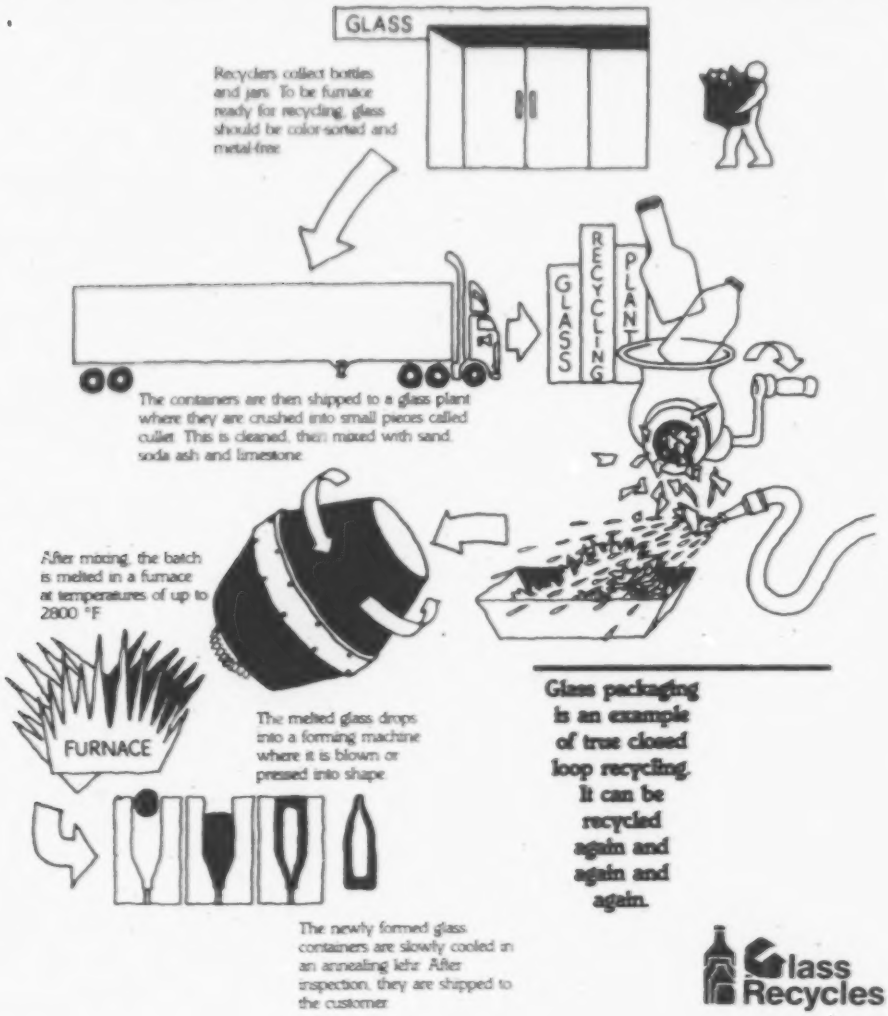
Once collected and separated into green, brown and clear colors at the Intermediate Processing Center (I.P.C.), glass is crushed into fragments called cullet. The cullet is sorted to remove contaminants that can cause flaws and impurities.

Cleaned cullet is added to the raw materials used in manufacturing new glass and melted in furnaces. The molten glass is poured into molds to form bottles and jars.

In addition to new beverage containers, cullet can be used to make fiberglass insulation, concrete, polymer composite sewer pipe, brick and terrazzo. It can also be used as a filler in paving, producing a road surface called glasphalt.

Adapted with permission from: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier, VT 05602

GLASS: 100% RECYCLABLE


GLASS
Recyclers collect bottles and jars. To be furnace ready for recycling, glass should be color-sorted and metal-free.
GLASS RECYCLING PLANT
The containers are then shipped to a glass plant where they are crushed into small pieces called cullet. This is cleaned, then mixed with sand, soda ash and limestone.
After mixing, the batch is melted in a furnace at temperatures of up to 2800 °F.
FURNACE
The melted glass drops into a forming machine where it is blown or pressed into shape.
The newly formed glass containers are slowly cooled in an annealing lehr. After inspection, they are shipped to the customer.
Glass packaging is an example of true closed loop recycling. It can be recycled again and again and again.
Glass Recycles

Glass graphic courtesy of: Carolina Glass Recycling Program, 908 South Tryon Street, Suite 2200, Charlotte, NC 28202

How Are Aluminum Cans Recycled?

Aluminum cans are 100% recyclable. The turnaround time for an aluminum can is only 90 - 120 days — from manufacture to filling, delivery to the store, purchase, use and recycling by the consumer, shipment to a processing plant, conversion into cansheet, remanufacture into another aluminum can, shipment to the filler, filling and shipment to the grocery or retail store.

Scrap dealers, who receive aluminum from recycling centers, sell recycled aluminum to smelters. The smelters must chemically analyze the aluminum they purchase, then shred and decontaminate it. Steel is removed from shredded aluminum as it passes over magnetized conveyor belts.

Once shredded and decontaminated, the aluminum scrap is melted for eighteen hours. Impurities are removed periodically. The molten metal is poured into forms and cooled. The resulting ingots are transported to manufacturing plants, remelted and formed into new products.

Adapted with permission from: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier, VT, 05602

How Is Paper Recycled?

Waste paper must be sorted prior to recycling. This ensures the best quality end-product and eliminates inks and adhesives that can damage processing machinery. Care also must be taken to store waste paper away from sunlight and water, which can break down cellulose fibers and render the paper unusable.

At recycling centers, paper is baled for shipping and transported to one of the more than 600 paper mills in the United States. At the mill, bales of waste paper are dumped into a pulper where a rotor mixes it with warm water and breaks down the cellulose fibers into slurry.

Once thoroughly mixed, the paper-water solution travels through centrifugal cleaning tanks and is bleached and de-inked. Chemical de-inking can contribute to water pollution, as can loss of short paper fibers through screens.

The slurry is deposited on screens, sent through rollers and formed into sheets of recycled paper in much the same way the original paper was made.

Adapted with permission from: Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier, VT, 05602

Papermaking

Subjects: Art, Science

Time: Two Hours

Focus: Recycling

Concept: Our natural resources can be reused and recycled into new and useful products.

Learning Objective: Students will learn how paper is recycled.

Background: Making your own paper from old paper is similar to what happens in a paper recycling mill. At a mill the pulp is put into a machine with a long moving screen. The water drips through the screen. Then the screen moves through parts of the machine that press and dry the pulp. The final product is new paper.

The paper you make will be much thicker and rougher than recycled paper made in a mill. Paper mills have many kinds of machines to make the paper smooth and flat .

Materials:

- "How To Make Paper" instructions
- Scrap paper (preferably white ledger paper, construction paper for coloring)
- Decorative filler scraps (flowers, seeds, pine needles, small pieces of colorful paper, yarn, thread, feathers, etc.)
- Two wooden frames the same size
- Nylon fly screening
- Many absorbent rags at least as large the frames
- One wash basin
- Blender or egg beater
- Pans, bowls
- Blotters
- Large mixing spoons
- Cups to scoop pulp
- Dishwasher detergent
- Sponge
- Iron to help dry the paper
- Worksheet, "How To Make Paper"

Procedures:

1. Explain the process of making paper.
2. Read "How To Make Paper."
3. Emphasize the reasons for recycling: resource conservation, less energy used, and less waste needing to be incinerated or landfilled. Also discuss the related problems of water pollution, contaminants, paper grades, costs of collection and transport, etc.

Extended Learning:

■ Children can write poems (e.g. Haiku) or try calligraphy on their paper (use pens or pencils that do not bleed).

■ Contact the local recycling coordinator in your town/city and learn what types of paper are commercially recycled, how to prepare the paper for recycling, and where the closest paper recycler is.

■ Weigh all the waste paper your class generates in a week. Separate the recyclable portion, and weigh the remainder to see how much the class can save for recycling. Have a contest with another class to see who can save the most.

Adapted with permission from Association of Vermont Recyclers, (A.V.R.), P.O. Box 1244, Montpelier, VT 05602

How To Make Paper

1. To make paper you must first make a 'paper mold' - a wooden frame with nylon fly screen stapled tightly to it. You can use a second wooden frame (deckle) without the fly screen to help make your paper more even.

2. Tear sheets of used paper into small strips, about one-inch square. Loosely pack into bowl or blender until 1/3 to 1/2 full. Add warm water until bowl or blender is 2/3 full.

3. Blend mixture with egg beater, or in a blender with the lid on, until the paper is the consistency of oatmeal mush. This will take 5 to 10 seconds. If you are coloring the paper by adding scraps of construction paper, add them now. You may also add food coloring, glitter and spices to the pulp. If you want to make white paper, add a small amount of dishwashing detergent to de-ink the paper.

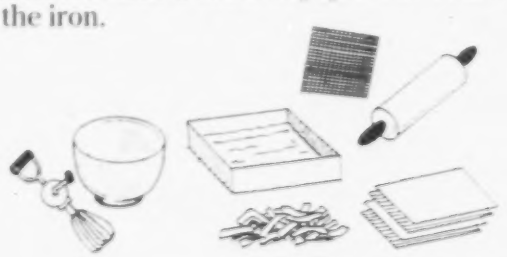
4. Pour into a pan. Add about 1/2 inch of water for every blender full of pulp.

5. Using a cup, scoop the pulp mixture evenly onto a screen. Let the pulp drain.

6. Place a piece of blotter over the wet sheet of paper on the screen. Then flip the screen over so the paper is between the blotter and the screen, with the screen on top.

7. Soak up excess water with a sponge. The water can be squeezed back into the pulp mixture.

8. Lift off the screen and place the new paper in a safe place to dry. Drying takes one to two days. Change the blotter every few hours if you want the paper to dry more quickly. The paper should not be touched or unnecessarily disturbed while drying. You may iron the paper to speed up the process. Place a sheet of paper between the newly-made paper and the iron.



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Section II
Solutions: We Can Make a Difference

IX. Composting

■ A Great, Rotten Idea

Overview:

Organic wastes can be recycled by composting. Composting creates optimal conditions for decomposition to occur. Decomposition is the biochemical process by which bacteria, fungi and other microscopic organisms break organic wastes into nutrients that can be used by plants and animals. Decomposition occurs in nature whenever a leaf falls to the ground or an animal dies. It is essential for the continuation of life on earth. The result of decomposition in a compost pile is a nutrient-rich humus that improves soil quality and facilitates plant growth.

In this lesson, students learn that approximately 30% of our household wastes can be recycled in a compost bin. A scientific experiment on composting, "*Creative Compost Column*," shows students how to construct a compost column that they can monitor over a period of months. They can also record their observations and any changes that occur on the "Creative Compost Column Observation Chart." Methods to conduct advanced composting experiments are also suggested. The resulting humus may be used to fertilize classroom plants or seedlings students plant and then bring home at the conclusion of the unit.

A Great, Rotten Idea

Subjects: Science, Health, Environmental Education, Agriculture, Home Economics

Time: Several Class Periods

Focus: Composting, Gardening

Concept: To have students investigate the benefits of composting.

Learning Objective: Students will:

- Understand the natural process of biodegration;
- Discover an easy and beneficial way to reduce yard and kitchen waste; and
- Learn the benefits of composting.

Background: When we mention "recycling," we often think of glass bottles, aluminum cans and newspapers. But another 30% of the household garbage we throw out can also be recycled. These recyclables are food scraps, leaves, grass clippings and other biodegradable organic wastes.

Materials:

- Rotting log
- Grass clippings
- Leaves
- Food scraps
- Worksheet "Creative Compost Column"

Procedures:

1. Teacher should define the words "recyclable" and "biodegradable" (see Glossary). Ask class to list items that fall into these categories. Are there recyclable materials that aren't biodegradable? Are there biodegradable materials that aren't recyclable?

2. Have class feel, smell and look at the rotting log, grass clippings, leaves and food scraps. Discuss what is happening to the rotting material.

   - What is the natural process that breaks biodegradable material into particles that can be used again by plants and animals?
     (decomposition)
   - What organisms assist in this decomposition process?
     (fungi, bacteria, earthworms, springtails, mites)
   - What will your rotting material finally become?
     (humus)
   - Imagine a world where decomposition doesn't take place. What would it be like? Could plants and animals survive if decomposition doesn't occur?
     (no)

3. Ask the class to think of words that describe rot or decomposition. List them on the chalkboard. Do the words have positive or negative connotations? Why?

4. Have the class produce a list of things their families throw away that are biodegradable. How might these be recycled? List some benefits of composting. Include the following:

   - Doesn't require plastic yard-waste bags to dispose of household and yard wastes.
   - Saves the cost of transporting and handling waste at landfills and incinerators
   - Saves space in landfills.
   - Creates nutrient-rich humus you can use to fertilize and improve the texture of your yard and garden soil.
   - Saves money otherwise spent for fertilizer.

5. Have the class list some possible problems with composting. What suggestions do they have for handling these objections?

   - "It's too much work."
     (Mowing the lawn and washing the car are work, too, but we choose to do these activities because they're satisfying. So is composting. And composting has a positive impact on the environment, which can make us feel good.)
   - "You'd have to run outside every time you eat an apple or peel a potato."
     (Place scraps in a plastic container with a lid. Keep the container near the kitchen sink. Take the waste to the compost pile whenever the container is full or when you throw out the garbage.)

6. Using the worksheet "Creative Compost Column Observation Chart" set up a compost pile in the classroom for students to monitor over a period of one to three months. Make weekly observations on the state of the column and record these on the observation chart on the worksheet on page 88. Discuss observations and changes week by week.

Extended Learning:

The possibilities for compost column explorations are endless. Design experiments that expand the children's knowledge of composting. Here are two possibilities:

- Make two identical columns and fill each with a known quantity of shredded newspaper. Use a balance to determine the weight of the paper. On top of one column, add a handful of garden soil (soil contains microorganisms). Pour equal amounts of water into each column and wait several hours for it to percolate through. If none comes out the bottom, add more in equal amounts until about a half cup drips into the base of each column. Schedule a rain storm to occur in the columns every few days. Which column decomposes faster? Why?

- Compost columns may be used to produce a liquid fertilizer called "compost tea." Try making several columns with different contents whose drippings differ in color and chemistry. Use the liquid to water and fertilize identical sets of seedlings. Which tea induces the fastest growth? Can you be sure the tea, and not some other factor, is responsible for the plant growth observed?

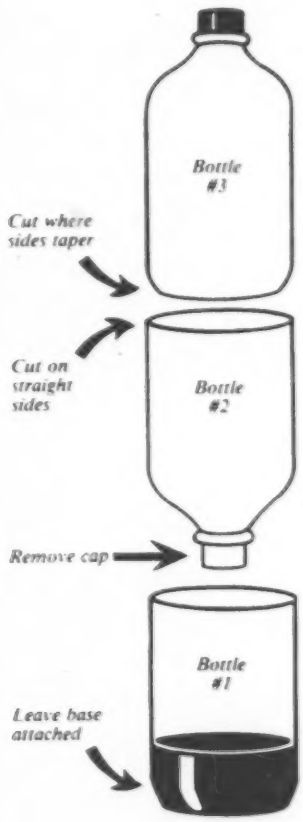
Creative Compost Column

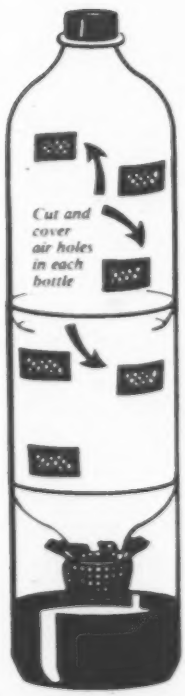
Organic waste can be disposed of in three ways: by chemical means (burning), physical means (landfilling) or biological means (composting). The objective of this activity is to understand the biological decomposition process.

Allow a minimum of one to three months for observation, depending on what is composted. This activity can be monitored throughout the school year for a long-term project.

Materials:

- Three two-liter plastic soda bottles, labels removed
- Scissors
- Razor blade knife
- Nylon stocking or other mesh material
- Electrical or duct tape
- Rubber band
- Water marking pen
- Centigrade thermometer
- Milliliter measuring cup
- Two cups of garden soil
- Food scraps (potato, carrot or fruit peelings)
- Yard waste (grass clippings and leaves)
- Plastic
- Newspaper or school paper





Procedures:

1. Cut the top off one bottle and the bottoms off two others. Arrange the bottles into a column as the diagram indicates. Cut out three or four windows (air holes) in the top two bottles of the approximate diameter of your thumb. Cover windows with nylon stocking or other mesh material and tape to hold firmly.

2. Place nylon stocking or other mesh material over middle bottle opening and secure the stocking or mesh with a rubber band.

3. Place soil in the middle bottle. Bury vegetable or fruit scraps, grass, newspaper, plastic, etc. in the soil. (Note: The smaller the pieces, the faster they will decompose.) Add just enough water to moisten the soil, and allow a few drops to drain into the bottom of the column.

4. Replace the top bottle, making sure the windows remain uncovered to allow air to flow in and out of the compost column.

5. During monitoring, keep soil moist by recycling the compost water from the bottom to the top bottle. Periodically turn the soil with a spoon.

6. Use the chart below to record any observable changes over a period of time.

Creative Compost Column Observation Chart

Date	Temperature (°C)	Odor (If any)	Amount of Water in Column Bottom (ml.)	Evidence of Organisms	Observations

Adapted with permission from Bottle Biology Resource Network, University of Wisconsin-Madison, B-37 Russell Laboratories, 1630 Linden Drive, Madison, WI 53706, (608) 263-5645. Funded by the National Science Foundation.

Glossary

Bi-metal: made of two different metals.

Biodegradable: the property of a substance that permits it to be broken down by microorganisms into simple, stable compounds such as carbon dioxide and water. (See "decompose.")

Bottle bill: a law requiring deposits on beverage containers, like aluminum cans and plastic bottles. Encourages recycling and discourages littering and landfilling. More accurately called a beverage container deposit law.

Composting: waste management process that creates an optimal environment for decomposition by layering organic wastes, like food scraps and grass clippings, so they will decay into fertile humus.

Conserve: to protect from loss or depletion. Conservation is the wise use of natural resources to minimize loss and waste.

Decompose: to break down into component parts or basic elements; to rot. Decomposition is imperative for the continuation of life, since it makes essential nutrients available for use by plants and animals.

Dump: open, unsanitary disposal site used before existence of licensed, controlled-burial sanitary landfills.

Energy recovery: the generation of energy by burning solid waste.

Environment: the physical, chemical and biological factors that surround and affect an organism.

Garbage: spoiled or waste food that is thrown away. Generally defined as wet food waste; excludes dry material (trash).

Ground water: water beneath the earth's surface that fills the spaces and moves between soil particles and rock. Supplies wells and springs.

Hazardous waste: waste that causes special problems for living organisms or the environment because it is poisonous, explosive, burns or dissolves flesh or metal, ignites easily with or without a flame or carries disease. Some hazardous wastes cause only one problem, others cause several.

Humus: organic material consisting of decayed vegetable matter that provides nutrients for plants and increases the ability of the soil to retain water.

Landfill: a site for the controlled burial of solid waste.

Leachate: liquid that has percolated through solid waste and/or been generated by solid waste decomposition and contains extracted, dissolved or suspended materials. May contaminate ground water or surface water.

Litter: waste materials discarded in an inappropriate place.

Methane: a colorless, odorless, flammable, potentially dangerous gaseous hydrocarbon (CH_4) present in natural gas and formed by the decomposition of organic matter. Can be used as a fuel.

Municipal solid waste: non-hazardous waste from households and commercial and industrial sites.

Natural resource: valuable, naturally occurring material such as soil, wood, air, water or minerals.

Non-renewable resource: a natural resource that, because of its scarcity, the great length of time it takes to form, or its rapid depletion, is considered finite in amount (e.g., coal, copper, petroleum).

Organic: derived from living organisms.

Pollution: harmful substances deposited in the environment, leading to a state of dirtiness, impurity or unhealthiness.

Precycling: reducing waste at the source by purchasing products that may be reused or recycled, buying in bulk, or buying items with less packaging or packaged in recyclable material.

Raw material: unprocessed natural resource or product used in manufacturing.

Recovery energy: see "Energy recovery."

Recyclable: An item made from material that can be recycled.

Recycle: the collection and reprocessing of manufactured materials for reuse either in the same form or as part of a different product.

Reduce: To lessen in extent, amount, number or other quantity.

Renewable resource: a natural resource derived from an endless or cyclical source (e.g., sun, wind, water, plants, animals). With proper management and wise use, replacement of these resources by natural or human-assisted systems can be approximately equal to their consumption.

Reuse: to extend the life of an item by using it again, repairing it, modifying it or creating new uses for it.

Sanitary landfill: a specially engineered site for disposing of solid waste on land. Constructed in a way that reduces hazards to health and safety.

Solid waste: all solid and semi-solid wastes, including trash, garbage, yard waste, ashes, industrial waste, swill, demolition and construction waste and household discards, such as appliances, furniture and equipment.

Solid waste management: the controlling, handling and disposal of all solid waste. One goal of solid waste management is to reduce waste to a minimum.

Source reduction: to decrease the amount of waste generated. (See "precycling.")

Trash: material considered worthless, unnecessary or offensive that is usually thrown away. Generally defined as dry waste material; excludes food waste (garbage) and ashes. The term is often used interchangeably with the word "garbage."

Waste-to-energy plant: a facility which employs burning techniques to produce saleable energy from solid waste.

Yard waste: garbage generated in the yard, such as grass clippings, branches and leaves.

Lessons and activities in this manual were adapted and reprinted from the following sources:

A.V.R. Teacher's Resource Guide
Association of Vermont Recyclers
P.O. Box 1244
Montpelier, Vermont 05601

A-Way With Waste
Washington State Department of Ecology
4350 150th Avenue, NE
Redmond, Washington 98052

Bottle Biology Resource Network
University of Wisconsin – Madison, B37
Russell Laboratories
1630 Linden Drive
Madison, Wisconsin 53706

Let's Reduce and Recycle
Curriculum for Solid Waste Awareness
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

Oscar's Options
Ocean State Cleanup and Recycling
Department of Environmental Management
Providence, Rhode Island 02908

Recycling Primer: Getting Back to Basics
State of Connecticut
Department of Environmental Protection
Room 108
165 Capitol Avenue
Hartford, Connecticut 06106

Lessons and activities in this manual were adapted and reprinted from the following sources: (continued)

Solid Waste Activity Packet for Teachers
Illinois Department of Energy and Natural Resources
Room 300
325 West Adams Street
Springfield, Illinois 62704-1892

Waste Away
Vermont Institute of Natural Science
P.O. Box 86
Woodstock, Vermont 05091

Wisconsin Department of Natural Resources
Bureau of Solid Waste
Information and Education
P.O. Box 7921
Madison, Wisconsin 53707

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Recommended Resources

Earthworks Group,
50 Simple Things You Can Do To Save The Earth,
Berkeley, CA, Earthworks Press, 1989

Earthworks Group,
The Recycler's Handbook,
Berkeley, CA, Earthworks Press, 1990

Garbage At The Grocery, Garbage,
The Practical Journal for the Environment, Boulder, CO, 1990

Jeffers, Susan,
Brother Eagle, Sister Sky: A Message From Chief Seattle,
Dial Books, Division of Penguin, New York, NY, 1991

Kalman, Bobbie
Buried in Garbage,
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Childrens Videos on the Environment

- **"The Rotten Truth"**
  Children's Television Workshop, a video designed for elementary and middle-level students on solid waste problems and solutions. Length 30 minutes. VCA/321 Contact, 50 Leyland Drive, Leonia, N.J. 07605, 1-800-822-1105 operator #12, ($14.95 plus $3.50 shipping).*

- **"Bottom of The Barrel"**
  3-2-1 CONTACT digs up the good and bad news about the stuff that's making headlines – oil. Length 30 minutes.

- **"Down The Drain"**
  3-2-1 CONTACT dives right in to take a close look at what's happening to our water supply. Length 30 minutes.

- **"You Can't Grow Home Again"**
  A special journey takes kids face-to-face with the beauty of rainforests, the threats to their survival, and the prospects for their future. Length 60 minutes.

- **"Help Save Planet Earth"**
  Easy Ways To Make A Big Difference, MCA Home Video, 1990 (Grades 3-6)

- **"The Lorax"**
  Dr. Suess, based on the book, Random House, New York, NY, (1971) $20 (can be purchased through Showtime Video) (Grades K-4)

* **Please note:** The first four videos listed on this page can be purchased through Wings for Learning 1-800-321-7511. The price for four videos, including shipping, is $65.00. (Grades 3-6)

Appendix A: School Recycling

As of January 1, 1991, nine items have been required to be source separated from the waste stream in accordance with ordinances adopted by Connecticut municipalities. They include: all glass food and beverage containers, all metal food and beverage containers, newspaper, corrugated cardboard, white office paper, waste motor oil, automotive batteries, scrap metal and leaves.

In accordance with the mandatory recycling law, Connecticut schools must recycle along with residents and businesses. Starting a recycling program at your school may seem like an enormous task to those who have never considered separating parts of their waste stream, but in practice it is not terribly difficult. You will find that most staff and students enthusiastically support recycling. The following hints are designed to make the start-up process flow smoothly.

Set up a recycling team that includes a commitment from your principal or director. The team should be comprised of representatives from all school groups and should develop a strategy for education, promotion, collection, storage, transportation, monitoring, evaluating, recording and reporting the results of the waste reduction and recycling program. Pick enthusiastic, positive people—their support is crucial to the success of the program.

Designate a coordinator to oversee the program.

Initiate a recycling and waste reduction educational program in your school for students, faculty, clerical staff, administrators and custodians.

Plan a kick off recycling event such as an assembly, a "recycling fair" or similar event.

Establish attainable goals to ensure continuing success in recycling and waste reduction. Goals may include:

1. Reducing the amount of school waste produced and reducing the cost of disposal.
2. Establishing and maintaining a successful waste reduction and recycling program in school.
3. Educating students and staff about waste management concepts and practices.
4. Helping to solve environmental land, air, and water pollution problems through advocacy.
5. Conserving resources and saving energy.

Before beginning your recycling program, conduct a waste audit to determine what waste is being generated, what is being thrown away, what currently is being recycled and what could be recycled. Conduct a study of existing disposal practices, including a breakdown of the current waste stream content by kinds of materials and volume per container in yards. Also calculate current disposal costs per container and total disposal cost on a monthly basis.

Before instituting a waste reduction and recycling program, schools need to contact the local fire marshal. For paper and other flammable materials, fire codes designate policies for storage of materials, preparation of materials, placement of collection receptacles, and types of collection receptacles permitted. Fire codes also address frequency of collection and the types of materials collected.

Contact haulers in your area to find out what your program options are.

Some questions the schools should ask the hauler:

1. What materials will you accept?

    a. Will pay for (how much)
    b. Will collect at no cost?
    c. Will collect but for a fee (What is the fee?)

2. How should materials be separated and collected and stored?

3. What will the hauler provide?

    a. Containers?
    b. Promotional materials?
    c. Transportation of recyclables from school?
    d. Frequency of service?
    e. Monitoring and reporting of materials being recycled?

4. How frequently will materials be picked up?

5. What is the minimum or maximum quantity accepted for collection?

6. Will the hauler provide a written contract for collection of materials for a specified length of time?

Small changes in school procedures and purchases can have a significant impact on reducing the amount of waste that requires recycling or disposal. A few suggestions are listed below:

1. If you and your students don't already do it, start using both sides of the paper and make double-sided copies whenever possible. This can cut your paper waste dramatically and will also reduce the amount of paper you have to purchase.
2. Instead of making individual copies for everyone, whenever possible, use a routing slip when circulating information to staff, or post notices on a bulletin board in central locations.
3. Use reusable envelopes for interoffice mail.
4. Do not purchase envelopes with cellophane windows or self-adhering note pads. If the windows are necessary, purchase the ones which have no covering over the window.
5. If applicable, use electronic mail instead of making hard copies of communications.
6. Request the removal of your name from junk mail lists by writing to the Direct Marketing Association, 6 East 43rd Street, New York, NY 10017.
7. If applicable, limit the number of subscriptions to periodicals and have classrooms share them. This will reduce both trash and subscription costs.
8. Arrange to have a vendor collect and recharge empty laser printer toner cartridges. Such cartridges can be recharged several times, saving money and disposal space.
9. Encourage employees and students to reuse paper clips, rubber bands and brass fasteners. These must be removed before recycling white paper.
10. Use scrap paper for messages. If you have access to a wax binder, you can make your own scrap paper pads.
11. Require suppliers who deliver products on pallets or in metal drums to take them back or exchange them on a one-for-one basis.
12. Have your cafeteria switch to reusable utensils instead of throwaways.
13. Encourage students who bring their lunch to do so using reusable lunch boxes instead of brown paper bags.
14. Replace single-strike film typewriter ribbons with ink impregnated nylon multistrike ribbons. The multistrike ribbons last 6-10 times as long as the single-strike variety. Do the same for printers that can utilize multistrike ribbons. (Some cannot.)
15. Replace ball-point or felt-tip pens with ones that take cartridges.
16. Purchase reusable and washable cleaning cloths, aprons, tablecloths, etc. rather than single-use disposable products.

17. Utilize washable crockery and utensils where feasible.
18. Buy institutional sizes of cleaning supplies, food products, beverages, etc. and repackage into smaller, reusable dispensers.

You will undoubtedly be able to add to this list after you complete a waste audit of your school. Please share your good ideas with others, especially members of your school associations.

Continued Support For Program

Renew interest in the recycling program with awards, media events, or contests among different groups in school. The local PTA may be a good resource for promotional campaigns, such as:

- A poster and slogan contest for the recycling program.
- A contest to guess the number of pounds of paper in a recycling bin with a prize for the closest guess; and
- A recycling trivia quiz concerning the amount of natural resources being saved by recycling.

The in-school waste reduction and recycling program can be beneficial for students, teachers and staff in the school and for the community at large.

If you require further information or need assistance with your program, call:

The Department of Environmental Protection
165 Capitol Avenue
Hartford, CT.
566-8722

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